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Patent Continuations, Product Lifecycle Contraction and the Patent Scope Erosion. – A New Insight Into Patenting Trends

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ABSTRACT **-** *This study was initiated in order to provide more factual insight into the recent debates on patent reforms in general and more particularly, the practice of patent continuations in the United States Patent and Trademark Office ("USPTO"). Several important trends that have not been previously quantified are brought to light. A quantitative analysis of various components of the flow of patent applications to the USPTO was carried out and insight into the ever-increasing propensity of patentees to file patent applications is presented. It is shown that with the exception of isolated transients due to patent law changes, the growth trend in each component of the number of patent applications is exponential in time. Original patent applications disclosing new inventions are shown to grow at a doubling rate of 14 years, a rate similar to that of the general growth of science. In contrast, continuation applications are shown to grow more rapidly at a rate proportional to that of new product introductions, doubling every 6.5 years. It is shown that such growth trends have persisted over the last quarter of a century. The continuation application growth trend is very likely a direct result of historical product life cycle reduction and the exponential growth in new product introductions, necessitating new or amended patent claims. In addition, evidence is presented that the product lifecycle reduction over time results in the grant of patents with progressively diminishing claim scope. This study shows that due to such acceleration of claim obsolescence and scope reduction, patent continuations at the USPTO is essential for applicants who seek to appropriate equivalent returns from their inventions. A critical discussion of other recent theories that attempted to explain patent continuations and the surge in patenting is also provided.*

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1 INTRODUCTION

Patentees in the United States are entitled to file follow-up patent applications and seek claims for inventions described but not claimed in their prior patent applications as long as such prior application is still pending. In so doing, applicants are entitled to a priority benefit under 35 U.S.C. §120, §121 or §365(c) conferring on the new application an effective filing priority date of the prior application filing date. The follow-up patent application process is an integral part of the U.S. patent system, having significant influence on the patenting trends and the scope of intellectual property appropriated through patents. Therefore, the study of U.S. patenting trends requires a detailed study of the trends, causes and effects of follow-up patent applications.

There are generally three types of follow-up patent applications entitled to the priority benefit of an earlier filed application: (i) *Continuation*[1] - a patent application made for the same invention as described in a prior application. The applicant and the disclosure presented in the continuation must be the same as in the prior application; (ii) *Continuation-In-Part*[2] ("CIP") – a patent application filed during the pendency of an earlier application by the same applicant, which covers a substantial portion or all of the subject matter of the earlier application and adds subject matter not contained in the earlier application. However, the inventor does not retain the original filing date for any claim in the CIP that draws its support from a material change in the written description[3]; and (iii) *Divisional Application*[4] - a later application for an independent or distinct invention, carved out of a pending application by the same applicant and disclosing and claiming only subject matter disclosed in the earlier parent application. A divisional application is usually filed because of a restriction requirement made by the examiner when the original application contains more than one independent invention. Applicant is then allowed to "elect" one of these inventions and related claims for prosecution and to file subsequent "Divisional" application, claiming other independent inventions.

The first category of follow-up patent applications – Continuations, is based on a practice of patent prosecution that has been an established procedure in USPTO practice and case law for more than a century[5]. This practice was codified first in the *Patent Act of 1952*[6] as 35 U.S.C. §120, to capture the procedural rights of an applicant with respect to continuations. Recently, continuations have received more attention by patentees, policymakers, scholars and lawmakers as the number of applications in this category experienced the highest growth rate among all application types. Unfortunately, along with the vast majority of applicants who legitimately engage in deliberate continued prosecution of additional claims to protect their inventions, there were also a few isolated cases of systematic abuse of the continuation process. It appears that very few applicants have engaged in extended and delayed prosecution in order to obtain what some have called "*submarine patents*". The submarine patent is issued from an application that has been out of public view during an abnormally long period of pre-grant review (prosecution) in the USPTO and covers technologies widely in use. By applying the doctrine of patent prosecution laches, the courts held such submarine attempts to have had "unreasonable and unexplainable" delay in prosecution[7]. As described below, patent law has changed in recent years, for the most part rendering submarine patents a thing of the past. Moreover, the state of the law and the federal courts' jurisprudence appear to enable a reasonable delineation of what constitutes unacceptable continuation practices that may result in the loss of patent rights[8].

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[1] *See* 37 C.F.R. §1.78 (2005); *See also* §201.07, Manual of Patent Examining Procedures ("MPEP"), USPTO, (August 2006), at http://www.uspto.gov/web/offices/pac/mpep/mpep.htm. The term File Wrapper Continuation was often used for these continuation applications. Alternatively, an applicant may file a "Request for Continued Examination" ("RCE") under 35 U.S.C. §132(b) (2000) in lieu of a continuation application after the prosecution of the application is closed but prior to abandonment, 37 C.F.R §1.114 (2005); MPEP §706.07(h). Applicants may also file a continuation application even if the examiner allows the claims, enabling the applicant to file (before a patent is issued) additional or broader claims if they are supported by the original specification (written description). *See also* notes 41, 42 and 43 below.

[2] *See* MPEP §201.08.

[3] It is thus possible for different claims in a patent based on a CIP to have different priority dates.

[4] *See* MPEP §201.06.

[5] For a review of the legal history of patent continuations, see: *Transco Products Inc. v. Performance Contracting, Inc.* 38 F.3d 551, 555-559, C.A.Fed. (Ill.) (Sep 14, 1994) (tracing the legal recognition of patent continuations back to the 1863 Supreme Court's *Godfrey v. Eames* decision and reviewing the factors connecting priority dates and the fulfillment of best-mode requirements under §112).

[6] Pub. L. No. 82-593, 66 Stat. 792 (1952) (codified as amended 35 U.S.C. §1 et seq.).

2 THE PATENT CONTINUATIONS DEBATE

Some critics of the patent system and some government agencies not specializing in patents have bemoaned the growth in the number of continuation applications and have linked the robust general growth with the occurrence of isolated abuse. They have called for sweeping changes to USPTO practices that would limit the rights of ***all*** patent applicants to engage in follow-up patent application practice[9]. Coupled with other deficiencies cited by these critics, they conclude that the patent system is "broken" and is harming the economy by curbing innovation[10]. Some critics have described the use of patent "thickets" not as tools for encouraging and financing innovation, but as tools of economic extortion and barriers to progress.[11] With substantial influence from certain large computer companies, the critics were initially persuasive in their advocacy for limiting the continuation practice. As a result, a few members of Congress introduced patent reform legislation that proposed to limit the use of continuations and to weaken other patent rights if enacted[12]. Responding in part to these calls and attributing its new initiatives to the growing workload and the need for patent quality improvements, the USPTO on its own has recently proposed to adopt new rules. In a notice of proposed rule making ("NPRM")[13], the USPTO has proposed a set of complex rules that it hopes will help compel more rapid advancement of originally filed patent applications to final agency action. These proposed rules would dramatically change the continued examination practice now available to applicants. This NPRM proposes to severely limit the opportunity for continued presentation of claims using the continuation and CIP examination practice. In a related proceeding[14], the USPTO also proposed to severely limit the number of claims it would accept in a patent application for initial examination. With the exception of support from large computer technology companies, the overwhelming majority of public comments on record in response to this NPRM are replete with objections, criticism and recommendations for alternative approaches[15]. Many have challenged the statutory authority of the USPTO to promulgate the specific provisions of its proposed rules[16]. The overwhelming majority of parties commenting argued that the proposed rules would not lead to greater efficiency in the examination process, would not reduce the pendency of patent applications, would deny basic property rights of patentees, would unduly burden them and would not improve the quality of issued patents. These parties argued that the proposed changes would more likely protract the examination process and divert scarce resources from examining activity to administrative tasks. The USPTO has not adopted the proposed rules as of this writing.

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[7] Celebrated representative cases include: *Symbol Technologies, Inc*. v. *Lemelson Medical*, 277 F.3d 1361, 161 Ed. Law Rep. 57, 61 U.S.P.Q.2d 1515 (Fed. Cir. 2002), *cert. denied*, 537 U.S. 825 (2002) (holding that equitable doctrine of laches could be applied to bar enforcement of Lemelson's patent claims that issued after "unreasonable and unexplained delay in prosecution" (38 years), even though Lemelson complied with pertinent statutes and rules); *In re Bogese*, 303 F.3d 1362, 64 USPQ2d 1448 (Fed. Cir. 2002) (while complying with all rules, Bogese's pattern of receiving a final rejection from the USPTO, filing a continuation application exactly or almost exactly six months later without any amendments, and abandoning his prior application, occurred 10 times between 1978 and 1994. The court found that this conduct rendered Bogese's application for patent unenforceable due to an "unreasonable and unexplained delay in prosecution").

[8] R.A. Migliorini, Lessons For Avoiding Inequitable Conduct And Prosecution Laches In Patent Prosecution And Litigation, *IDEA*, **46**, p. 221, (2006),(reviews the doctrines of inequitable conduct and prosecution laches and their potential impact in the context of patent prosecution and litigation and provides suggestions for avoiding these doctrines when preparing and prosecuting patent applications); L.A. Dolak, The Ethics Of Delaying Prosecution, *American University Law Review*, **53**, pp. 739-771, (2004) (reviews the history and case law related to all practices that have the effect of delaying patent prosecution); *See also* M.T. Hawkins, Prosecution Laches in the Wake of Symbol Technologies: What is "Unreasonable and Unexplained" Delay?, *Minnesota Law Review* **87**(5), pp. 1621, 1655-60 (May 2003) (analyzing factors for distinguishing between legitimate "commercial gamesmanship" and "unreasonable and unexplained delay" for purposes of prosecution laches). *See also* Sullivan and Loretto (2005), note 33, discussing the effective legal bars against asserting patent claims procured through lengthy questionable prosecution practice due to successful defensive doctrines against such claims.

[9] *See, e.g.*, Inter-government agency hearing on *Competition and Intellectual Property Law and Policy in the Knowledge-Based Economy* (2002). At http://www.usdoj.gov/atr/hearing.htm; The Federal Trade Commission made specific recommendations to curtail substantially the rights of patentees to file continuations in its report "*To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*", (October 2003), at http://www.ftc.gov/opp/intellect; hereinafter referred to as "FTC (2003)"; National Academy of Public Administration, *U.S. Patent and Trademark Office: Transforming to Meet the Challenges of the 21st Century*, (January 2006) at http://www.napawash.org (**). *See also* note 64.

[10] These scholar-critics allege that the patent system is 'broken' because "bad", questionable or poor quality (invalid) patents are being issued by the USPTO and because the USPTO is granting too easily, too many patents. They provide no evidence to support these assertions. They contend that patent examiners are overburdened and do not spend enough time examining applications. The patent system is broken, the critics allege, because it is harder to invalidate a patent in court today than it was 30 years ago. For this general topic, see the references in note 64, but *see also* Section 4.3 discrediting with actual data the "patent friendly" courts theory, and see a further detailed rebuttal in: P. Doody, The Patent System Is Not Broken, *Intellectual Property & Technology Law Journal*, **18**(12), pp. 10-24, (December 2006).

[11] *See* FTC (2003), note 9 above, Ch. 3 at 34-37, 50-55 (discussing how patent thickets impede innovation in the electronics industry and in the software and Internet industries)."

Advocates for maintaining the present continuation practice highlight the fundamental characteristics of the invention process. They contend that assessing prior art and defining the invention is a complex and protracted process which requires several opportunities during the pendency of an application for reevaluation of the scope of protection in light of new information, claim construction issues, and possibly market experience. The experience of many patentees is abundant with instances requiring filing of patent continuations during the pendency of a prior application that could not have been reasonably predicted or made during the prior application. These instances include but are not limited to

(i) Attempts to amend claims in order to overcome an examiner's final rejection based on new grounds or where an applicant and an examiner simply have not had an adequate exchange regarding the issues surrounding certain claims in an application;

(ii) Amending claims in view of newly discovered prior art that later came to the attention of the applicant during foreign counterpart application examination or through other market sources and circumstances;

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[12] *See* HR-2795, *Patent Reform Act of 2005*. Proposed Section 123 would authorize the USPTO Director to limit the use of continuation applications. Interestingly, this provision and certain other patent enforcement weakening provisions of this House bill have been omitted from the Senate bill S-3818, *Patent Reform Act of 2006*, introduced by Senator Hatch on August 3, 2006. As of this writing, no further legislative action on either bill has since taken place.

[13] USPTO Docket No. 2005-P-066, Notice of Proposed Rule Making "*Changes to Practice for Continuing Applications, Requests for Continued Examination Practice, and Applications Containing Patentably Indistinct Claims*", **71** *Fed. Reg.* 48, (January 3, 2006). At http://www.uspto.gov/web/offices/com/sol/notices/71fr48.pdf.

[14] USPTO Docket No. 2005-P-067, Notice of Proposed Rule Making, "*Changes to Practice for the Examination of Claims in Patent Applications*", **71** *Fed. Reg.* 61, (03 January 2006). at http://www.uspto.gov/web/offices/com/sol/notices/71fr61.pdf.

[15] USPTO Docket No. 2005-P-066, Comments on the NPRM. At http://www.uspto.gov/web/offices/pac/dapp/opla/comments/fpp_continuation/continuation_comments.html.

[16] *See e.g*, Biotechnology Industry Organization, The Comments of the Biotechnology Industry Organization on the United States Patent & Trademark Office Proposed Rules Changes Concerning Continuation Practice and Claim Limitations, *Biotechnology Law Report*, **25**(4)**,** pp. 473-483, (August 2006), (showing at page 478 the inconsistencies between the proposed rules and the statute); S.T. Schreiner and P.A. Doody, Patent Continuation Applications: How The PTO's Proposed New Rules Undermine An Important Part Of The U.S. Patent System With Hundreds Of Years Of History, *Journal of the Patent and Trademark Office Society*, **88,** p. 556, (June, 2006) (explaining at page 566 that the proposed USPTO rules contravene the statute).

(iii) Amendment/addition of claims to cover a feature of the disclosed invention not claimed before but that was later found to be essential for the protection of applicant's new product(s); and

(iv) Amendment/addition of claims to cover previously unclaimed features of the disclosed invention that were later discovered to be in other third party's product(s).

The practice of type (i) listed above must be rather common in view of the fact that in recent years requests for continued prosecution of existing claims consistently represented about 60% of all continuations[17]. Evidently, much of the debate on limiting patent continuations stems from the opinion of some scholars and observers that the practice of type (iv) listed above is abusive, suppresses follow-up innovation and therefore should be abolished altogether. However, these critics offer no analysis of the innovation suppression effects due to their proposed denial of inventors' ability to fully appropriate their inventions under a proposed limitation of such continuation rights. A fact often ignored by these critics is that the practice of type (iv), which they call an *egregious abuse* of the continuation process[18], is in fact a legitimate intellectual property protection right as conferred by Congress over the years under 35 U.S.C. §120, §121 or §132(b) and repeatedly sanctioned by the courts. Indeed, courts have recognized that the process of claiming one's invention need not end upon the first disclosure in an original patent application. They held that applicants have the right to obtain claims written or amended during prosecution ***specifically in order to cover a competitor's product*** and that the genesis of such amendments in the marketplace is simply irrelevant[19]. In other instances, some observers reporting on the continuation practice as abusive apparently do so based on a misconception of the legal rules that govern patent continuations. They imply the existence of a "legal loophole" where in fact none exists[20].

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[17] The data in Appendix A shows that since 1998, the total number of CPAs and RCEs exceeded that of regular continuations. Unlike regular continuation application, these types of specialized continuations do not receive a new application number or a new application date upon their filing, as they nominally reflect a resumption of an incomplete prosecution of claims submitted in prior applications.

[18] M.A. Lemley and K.A. Moore, Ending Abuse Of Patent Continuations, *Boston University Law Review*, **84**, p. 63-123, (2004), at 107. *See also* note 64 below.

[19] Contrary to popular belief, the judicial record in this regard is replete with unambiguous decisions: *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 69 U.S.P.Q.2d 1801 (Fed.Cir.2004) ("The district court recognized that it is not improper for an applicant to broaden his claims during prosecution in order to encompass a competitor's product, as long as the disclosure supports the broadened claims"); *PIN/NIP, Inc. v. Platte Chem. Co.*, 304 F.3d 1235 (Fed.Cir.2002) ("While it is legitimate to amend claims or add claims to a patent application purposefully to encompass devices or processes of others, there must be support for such amendments or additions in the originally filed application"); *Multiform Desiccants, Inc. v. Medzam, Ltd.*, 133 F.3d 1473 (Fed.Cir.1998) ("it is neither illegal nor bad faith for an applicant to amend the claims in view of a competitor's product"); *Texas Instruments, Inc. v. U.S. International Trade Commission*, 871 F.2d 1054, 1065 (Fed. Cir 1989) (holding a broader interpretation of Texas Instruments' claim and noting, while citing *Kingsdown*, that it was properly broadened during prosecution to cover the competing Mostek DRAM); *Kingsdown Med. Consult. v. Hollister*, 863 F.2d 867 (Fed. Cir. 1988) (finding nothing improper, illegal or inequitable in amending or inserting claims intended to cover a competitor's product during the prosecution of a patent application.); *State Indus., Inc. v. A.O. Smith Corp.*, 751 F.2d 1226, 1235 (Fed. Cir. 1985) (finding it proper to track one's competitor's products and modify one's patent claims accordingly). *Micro-Acoustics Corp. v. Bose Corp.*, 493 F.Supp. 356, 367 (S.D.N.Y.1980) ("There is nothing wrong with broadening the claims to cover competitive devices about which the applicant ... learns after the application is filed, so long as the claims are supported by the specification."); *Penn Yan Boats, Inc. v. Sea Lark Boats, Inc.*, 359 F.Supp. 948, 954-55 (S.D.Fla.1972) ("There is nothing inherently wrong or dishonest in amending claims in a pending application during the course of prosecution … in order to insure that the claims which ultimately appear in the issued patent will cover the commercial activity of third parties, whose potentially infringing activities are discovered subsequent to the filing of a patent application, so long as the claims are supported by the original patent application disclosure.").

[20] E. Kintisch, U.S. Wants to Curtail Add-On Patents to Reduce Backlog, *Science*, **313**, pp. 425-427, (July 28, 2006) (calling patent continuations a "well-used loophole in U.S. patent law" that permits patentees to "continually ***add detail*** to a pending application while benefiting from the early filing date of the initial scientific discovery" (emphasis supplied). The fact is, that no such ability to add detail while claiming the early filing date exists under patent law. 35 U.S.C. §112 requires support in the original disclosure for ***any*** claim and thus ensures that no such

Patent practitioners who are familiar with the details of patent practice contend that the critics of the continuation process often fail to fully appreciate the challenges, uncertainties and complexities of claiming ***all aspects and features*** of inventions, which the continuation process facilitates. Patent property rights are unique in that a map, a diagram or a list of coordinates cannot describe their boundaries. Rather, the boundaries must be claimed and conveyed by the use of words and determining where exactly these boundaries reside is often dispositive of such crucial issues as patent validity and infringement. But the nature of language renders illusive any hope of fully describing the boundaries for all aspects and features of an invention because, as the Court of Claims once noted, "things are not made for the sake of words, but words for things"[21]. Yet, the plain meaning of words in a claim often does not convey their actual legal scope[22], a factor further complicated by the fact that patent claim terms require differing interpretations throughout time[23]. Claim construction has become a non-trivial matter fraught with ever-increasing uncertainty. This is manifested by the increase to 40% in the rate of Court of Appeals for the Federal Circuit ("CAFC") reversals of appealed district court claim construction decisions, giving rise to even greater uncertainty[24]. Due to this uncertainty, an elaborate ***sequential*** process of claim drafting, submission and examination is often necessary to effectively claim the full scope of complex inventions. Based on allowed initial claims, applicants learn the "territorial limits" and best claim words to recite subject matter pertinent to their invention. Resources can then be invested more efficiently (by applicants and by the USPTO) in directing and examining other complementary claims towards matters more likely to be allowable. For example, in a communications system, it can be crucial to have separate claims directed to the transmitter, the receiver, and even to their combination as a system. Method claims directed to steps practiced in each of these elements are often sought as well.

Examples of continuation applications that legitimately seek to obtain the full scope of an invention include cases where multiple claims are drafted to literally cover foreseeable equivalents. This approach simplifies complex "doctrine of equivalents" cases[25] so that clear literal infringement claims can be asserted. Claim construction for covering equivalents is also fraught with uncertainty and courts have held that a patentee disclosing but not claiming a subject matter may be surrendering to the public that which was unclaimed. In that event, the patentee may not be entitled to recapture the foreseeable equivalents under his claim[26]. As a remedy, the court explicitly suggested that as a general rule,

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"loophole" exists. For a more detailed critique of Kintisch's article, *See* L.B. Ebert, On The Proposal To Restrict Continuing Applications, *Journal of the Patent and Trademark Office Society*, **88**, p. 743, (Sep. 2006)).

[21] *Autogiro Co. of America v. U.S.*, 181 Ct.Cl. 55, 384 F.2d 391, 397 (Oct 13, 1967) ("An invention exists most importantly as a tangible structure or a series of drawings. A verbal portrayal is usually an afterthought written to satisfy the requirements of patent law. This conversion of machine to words allows for unintended idea gaps which cannot be satisfactorily filled. Often the invention is novel and words do not exist to describe it. The dictionary does not always keep abreast of the inventor. It cannot. Things are not made for the sake of words, but words for things").

[22] C.A. Nard, A Theory of Claim Interpretation, *Harvard Journal of Law & Technology*, **14**(1), pp. 1-82, (Fall 2000) (recounts the shortcomings of the plain meaning rule as applied in claim construction and notes that it has been widely discredited).

[23] M.A. Lemley, The Changing Meaning Of Patent Claim Terms, *Michigan Law Review*, **104**, pp. 101-122, (2005) (discussing claim construction and reviewing the legal principles requiring that claim terms be construed based on their meaning at differing times - the patent conception time, application filing time, grant time and alleged infringement time).

[24] K.A. Moore, *Markman* Eight Years Later: Is Claim Construction More Predictable?, *Lewis And Clark Law Review*, **9**(1), pp. 231-247, (2005) (showing at page 246 that the CAFC reversed patent claim construction cases appealed from the federal district courts at a rate of 20% in 1998, gradually reaching reversal rates of approximately 40% during 2001-2003). Some scholars attributed much of this high level of reversals to the uncertainty introduced by the CAFC itself, having rendered decisions inconsistent with its own doctrines or even with those of the U.S. Supreme Court. *See* P.M. Janicke, On the Causes of Unpredictability of Federal Circuit Decisions in Patent Cases, *Northwestern Journal Of Technology And Intellectual Property*, **3**(2), pp. 93-110, (Spring 2005) (reviews the scholarly work on CAFC unpredictability but concludes that the breadth and generality of the patent statute are the largest factors making the outcomes of particular patent litigations unpredictable).

[25] See note 161 below and related text for discussion of the Doctrine of Equivalence.

[26] *Johnson & Johnston Associates Inc. v. R.E. Service Co., Inc.* 285 F.3d 1046, 1054, C.A.Fed. (Cal.), (Mar 28, 2002) (en banc) ("when a patent drafter discloses but declines to claim subject matter, as in this case, this action

applicants can use continuation practice to claim and perfect their rights to previously unclaimed but disclosed subject matter[27]. Accordingly, continuation claims that unambiguously cover an accused infringer's product can protect against the uncertainty that exists in claim construction. In other cases, continuation claims are drafted to deal with claim construction rules for means-plus-function, product-by-process, functional apparatus, structural apparatus, method-of-making, and method-of-using claims. These are all instances where the words in claims submitted in original applications are insufficient, and words chosen in claims obtained through the sequential mechanism of continuation practice actually reduce the costs of patent prosecution and litigation by turning unclear cases into clear ones.

In addition, advocates of preserving the current patent continuation system argue that, if adopted, the proposed rule change would have a chilling effect on investments in new technology companies that depend on patent protection[28]. The concern is that the proposed rules will eliminate flexible means of private appropriation of many features and facets of disclosed inventions, thereby forcing applicants to dedicate certain parts to the public. Currently, these flexible means enable applicants to prioritize and sequentially distribute over time the content and prosecution cost of their claims. This permits applicants to better match the scope of continuation claims to new products as they are introduced to the market. Absent such flexible means of securing prospective rents from their inventions, companies may find their prospective investors reluctant to invest due to the higher attached risk. Hence, this reduction in a company's ability to obtain patent protection may very well drive investment decisions away from what could have been important advances in technology.

Those opposed to the USPTO rule change proposals contend that essentially all the factors that might have provided incentives for abusing the continuation process have been eliminated from the U.S. patent system. Since a new patent law[29] took effect in 1995 (as discussed in Section 3.2.1), the term of U.S. patent protection has been changed from 17 years after the grant date to twenty years from the earliest priority application date, rendering the grant date (or a delay thereof) irrelevant to the patent expiration date. Moreover, in the *Domestic Publication of Foreign Filed Patent Applications Act of 1999*[30], Congress amended the practice in which pending applications remained confidential by requiring that most[31] patent applications be published eighteen months after their submission to the USPTO. Applications published pursuant to this law were first made public in March 2001. Applicants have also been provided with substantial incentives to have their application and claims published prior to issuance. The provisional rights under 35 U.S.C. §154(d) (2000) now awards patentees a reasonable royalty for infringement that occurs after publication but ***before*** patent issuance[32]. These changes essentially cap any

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dedicates that unclaimed subject matter to the public"); *Maxwell v. J. Baker, Inc.*, 86 F.3d 1098, 1108 (Fed.Cir.1996) ("By [Maxwell's failure] to claim these alternatives, the PTO was deprived of the opportunity to consider whether these alternatives were patentable. A person of ordinary skill in the shoe industry, reading the specification and prosecution history, and interpreting the claims, would conclude that Maxwell, by failing to claim the alternate shoe attachment systems in which the tabs were attached to the inside shoe lining, dedicated the use of such systems to the public").

[27] *See* e.g. *Johnson & Johnston* (2002), note 26 above, at 1055 ("A patentee who inadvertently fails to claim disclosed subject matter … is not left without remedy [and] … can file a separate application claiming the disclosed subject matter under 35 U.S.C. § 120". Justices Mayer and Rader stated in their concurrence at 1057: "When one of ordinary skill in the relevant art would foresee coverage of an invention, a patent drafter has an obligation to claim those foreseeable limits").

[28] Letter to The Honorable Jon Dudas, Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office, by Mark Heesen, President of the National Venture Capital Association, (May 3, 2006) at http://www.uspto.gov/web/offices/pac/dapp/opla/comments/fpp_continuation/nvca.pdf

[29] Pub. L. 103-465, §532(a)(1), 108 Stat. 4983, (Dec. 8, 1994).

[30] Pub. L. 106-113, §1000(a)(9), 113 Stat. 1501A-561 to -566 (codified at 35 U.S.C. §122 (2000)).

[31] The statute requires publication only of those applications that will also be filed abroad: 35 U.S.C. § 122(b)(2)(B)(i) ("If an applicant makes a request upon filing, certifying that the invention disclosed in the application has not and will not be the subject of an application filed in another country . . . the application shall not be published.").

[32] *XCO Intern. Inc. v. Pacific Scientific Co.*, 369 F.3d 998, 1007 (7th Cir.(Ill.) May 24, 2004) (generally recognizing that the filing of a patent application provides protection under 35 U.S.C. §154(d)); *Stephens v. Tech Intern., Inc.*,

"ambush" incentives for applicants' lengthy prosecution of their patents, and coupled with the new patent application publication provisions, the possibility of "submarine patents" is reduced substantially.

Finally, it should be noted in connection to allegations of abuse that it has become much harder for a patentee to assert patent claims procured through lengthy questionable prosecution practice that later bear the statutory imprimatur of validity. Reliance on such practices often turns into a liability for the patentee due to recent case law affirming certain defensive doctrines against such claims. Sullivan and Loretto[33] review these available defensive doctrines, such as the judicially reinvigorated application of enablement, written description, and definiteness requirements under 35 U.S.C. §112. These are especially apt for denying patentees the ex-post benefit of ambiguous or manipulative use of language. Thus, such defensive doctrines are well suited to the equitable task of separating the actual inventors who had possession of the innovative features of a novel advancement at an early date, but simply lingered in perfecting these rights, from the patent applicants and litigators who did not invent anything that they seek to cover. Sullivan and Loretto also discuss the reverse doctrine of equivalents for proving non-infringement in such situations and the defensive assertion of inequitable conduct, patent misuse, and antitrust liability for demonstrating patent unenforceability[34]. Thus, all these effective defensive doctrines serve as further deterrents against a continuation practice that might legitimately be alleged as abusive.

Based on USPTO information (see Section 3.1), the number of continuation applications of all types[35] filed in the USPTO grew from approximately 6,000 per year in 1980 to over 85,000 per year in 2005. Hence, since 1980, the cumulative number of continuation applications by the close of fiscal year 2005 exceeded 0.8 million. As Section 4.4.3 shows, there is evidence that such growth is not due to abusive practices. There is no doubt that those directly in the path of ***a few*** patents that were improperly obtained through protracted submarine continuation tactics were affected profoundly and may have even been harmed. However, this does not explain or account for the motivation and causes behind the exponential growth culminating in over 0.8 million applications for patent continuations. Clearly, there is something else and more profound going on here: Growth phenomenon that has not heretofore been satisfactorily explained. Others have put forth several theories for accounting for the increased patenting trends in general and continuation patenting in particular. However, these theories appear seriously deficient as they lack the factual underpinnings, or because they conflict with contrary evidence, to support their contentions. A more detailed discussion of this is presented Section 4.4.

The contribution of this present study on patenting continuations is that it seeks to factually account for the observed growth. It distills the available USPTO patent application statistical data into its components, separating continuation applications from original and other application types. This separation permits a time-series analysis of the continuation application category. This study is the first to quantitatively account for the observed exponential growth rate of continuations. It is the first to suggest that the observed growth rate and its relation to new product introductions is a manifestation of legitimate, longstanding and rational market behavior of private property owners. The observed trends are shown to be consistent with a fundamental pattern under which these owners merely seek to lawfully protect their investments in inventions embodied in new products within the *rapidly changing economic environment*

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393 F.3d 1269, 73 U.S.P.Q.2d 1369, (Fed.Cir.(Nev.) Dec. 29, 2004) (finding that after providing a §154(d) notice to a potential infringer, a patent applicant is not required to withdraw its Section 154 notice even if the claims are being amended, giving the patentee the right to await possible patent issuance to see if its infringement allegations were correct). *See also* P. Signore, The New Provisional Rights Provision, *Journal of the Patent & Trademark Office Society*, **82**, pp. 742-748 (Oct. 2000) (Lacking the benefit of later court cases cited herein, the article reviews the law change shortly after its enactment).

[33] J.D. Sullivan and D. Loretto, Symbol Technologies v. Lemelson, Prosecution Laches, and The Still-Unmet Challenges Of Junking "Junk Patents", *AIPLA Quarterly Journal*, **33**, pp. 285-324, (Summer, 2005).

[34] Sullivan and Loretto (2005), note 33, at 311-317.

[35] The types used over the years are (i) Applications for continuation, (ii); Continued Prosecution Applications (CPAs); (iii) Requests for Continued Examination (RCEs); and (iv) Rule 129 Continuations. See Section 3.1 for further details.

of diminishing product life cycle time. Thus, the patent continuation applications growth trend is shown to essentially follow the same growth rate as that of new product introductions. The reasons for this linkage are discussed in more detail in the various sections of this paper. Marshaling a range of other evidence, this paper concludes that the product lifecycle reduction over time results in issuance of patents with progressively diminishing claim scope. While not completely unassailable, this conclusion is consistent with both legal and economic factors as presented in this paper. It is shown that patent continuations contribute to such trends, which are in fact economically more optimal for private and public welfare.

This study is primarily concerned with aggregate patenting trends across all industries and commercial fields. No specific breakdown by industry or by art classification is attempted. It is at this macro level that the general trends and growth rates are observed and analyzed. While individual industry segments may differ in these characteristics, it is suggested that the overall average trends described here provide significant broader insight into the innovation appropriation process across industries. While much has been written about the shortcomings of the U.S. patent system, this paper is providing evidence and insight into its positive attributes and strengths as compared to that of other nations.

The structure of this paper is as follows: Section 3 describes the data set used in the study. Section 3.1 presents the results as an historical time-series. As part of the historical trend analysis, Section 3.2 digresses somewhat in order to account for the peculiar applications' count transients of 1982 and 1995. The discussion of findings follows in Section 4. It includes Section 4.2 on product life cycle reduction and its relation to patent claims obsolescence. The related topic of patent scope erosion is discussed in Section 4.3. Section 4.4 critically reviews other theories of patenting trends and identifies their shortcomings in explaining the observations of this and other studies.

3 THE STUDY DATA SET

Numerous studies have addressed the historical patterns of patent applications and grants in the USPTO as well as other attributes and information provided in various data fields within the face of granted patents[36]. For the most part, as they pertain to U.S. patent information, these studies were based on the historical records made available by the USPTO in its publications, which are now made widely available via the USPTO web site[37]. However, the published information in the USPTO reports provides annual information on the total number of applications without breaking the figures down to the various ***types*** of patent applications. In its total patent application count, the USPTO lumps together the numbers for original applications, continuation applications, Continuation-In-Part (CIP) applications and Divisional applications. Because these application types differ in their scope and purposes, their use patterns and temporal dynamics point to different factors and underlying reasons for their filing. In order to better understand these underlying factors, it is important to analyze the appropriate subgroup types of these applications. The only studies that this author is aware of which separate the USPTO application types are those led by Cecil Quillen[38]. However, his papers were directed at studying USPTO grant performance and did not address the causal factors of historical patenting trends.

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[36] See the review by Z. Griliches, Patent Statistics As Economic Indicators: A Survey. *Journal of Economic Literature*, **28**(4)**,** pp. 1661–1707, (December 1990). See also: C. Long, Patent signals, *University Of Chicago Law Review*, **69**(2), pp. 625-679, (2002); For recent sources, see citations in I. van Wartburg, T. Teichert and K. Rost, Inventive Progress Measured By Multi-Stage Patent Citation Analysis, *Research Policy*, **34(**10), pp. 1591-1607, (December 2005).

[37] See the USPTO Statistical Information page at http://www.uspto.gov/web/offices/ac/ido/oeip/taf/index.html

[38] C.D. Quillen, Jr. and O.H. Webster, Continuing Patent Applications And Performance Of The U.S. Patent Office, *Federal Circuit Bar Journal*, **11**(1), pp. 1-21, (August, 2001) (the first study to report separately on application types); C.D. Quillen, Jr., O.H. Webster and R. Eichmann, Continuing Patent Applications and Performance of the U.S. Patent and Trademark Office—Extended, *Federal Circuit Bar Journal*, **12**, p. 35 (2002) (extending the data to fiscal year 2000); C.D. Quillen Jr., Abolish Continuing Patent Applications?, *Patent Quality Conference*, Intellectual Property Owners Association, (April 19, 2004) (extending the updated information to FY 2002); C.D. Quillen, Jr.

Although Section 4.2.2 provides some insight into certain factors pertaining to patent grant statistics, for the most part, this present study focuses on the patent application process and not directly on pendency or the patent examination and grant process. Here, data in which application types are separately broken down was obtained from the USPTO response to a Freedom Of Information Act ("FOIA") request[39] filed with the USPTO. In addition, data from a recent slide presentation by the USPTO that provided annual continuation applications count since 1980[40], was used to the extent it corrected prior errors in the FOIA data. Section 3.2 employs data from the USPTO database available on its web site and used in the aggregate, counting records and hits in response to specific composite queries, as described therein. In addition, other historical data sources are used and their descriptions can be found in the relevant sections. Appendix A provides a tabulation of the data set used in this study.

3.1 Data Analysis Results

From the FOIA USPTO data, a category defined here as **Continuations** was made. It comprises the aggregation of the historical numbers for all patent applications that are (i) File Wrapper Continuations, (ii) Continued Prosecution Applications (CPAs)[41], (iii) Requests for Continued Examination (RCE) applications[42], and (iv) Rule 129 Continuations[43]. While the use of these subcategories varied over the years, the minor differences among them are predominantly procedural. They are all applications having no new disclosure, initiated by applicants seeking examination based on subject matter first disclosed in prior applications. By subtracting the total number of these **Continuations**, **CIP**s and **Divisions** from the total published USPTO utility patent application count, one obtains the number of **Original** applications filed with new disclosure[44] that claim no priority to a prior non-provisional U.S. case.

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and O.H. Webster, Continuing Patent Applications and the U.S. Patent and Trademark Office – Updated, *Federal Circuit Bar Journal* **15(**4), pp. 635-677, (2006) (the most recent study updating to FY 2005).

[39] USPTO-FOIA Request No. 6 062, response dated December 22, 2005.

[40] USPTO, "Proposed Rule Changes to Focus the Patent Process Involving Continuations, Double Patenting and Claims", Presentation, *Connecticut Intellectual Property Law Association*, Slide 9, (March 29, 2006), available at http://www.uspto.gov/web/offices/pac/dapp/opla/presentation/connipla032906.ppt

[41] CPA practice pursuant to 37 C.F.R. § 1.53(d) is not applicable to provisional applications or during reexamination or to any utility or original plant applications filed on or after May 29, 2000 (including reissue). After establishing the RCE practice, effective July 14, 2003, the USPTO eliminated the use of CPAs except for design patents.

[42] RCE under 35 U.S.C. § 132(b), pursuant to 37 C.F.R. § 1.114 is in fact continued examination of the same application that enables an applicant to purchase additional examination cycles for new claim amendments after the examiner issues a final rejection. As of August 16, 2000, RCEs must be filed after the prosecution of an application is closed but is not applicable to provisional applications, design applications, applications filed before June 8, 1995, or during reexamination.

[43] Continuation applications pursuant to 37 CFR §1.129(a) were applicable only to original utility or original plant applications filed before or on June 8, 1995, and which have been pending for at least two years as of June 8, 1995. These date limits virtually made Rule 129 practice date-wise mutually exclusive with RCE practice. Continuations pursuant to this rule must be filed after final rejection and before an appeal brief is filed and is in fact continued examination of the same application. Applicants may not switch inventions (divisional equivalent) as a matter of right or add new matter (CIP equivalent).

[44] Of course, although 'original' as a first application for patent at the USPTO, some of these applications may not be strictly 'original' as they may be claiming the priority benefit of a prior foreign application or a provisional U.S. application. Hence, what this study defines as an "Original" patent application, is essentially a 'Parent' to a National Patent Family whose members are other patent applications that are grouped here under the terms Continuations, CIP and Divisional applications. Note, however, that this terminology is in variance with that used by the World Intellectual Property Organization ("WIPO"), wherein a "National Patent Family" *does not* include Continuations that are patent documents published at different procedural stages (such as an RCE) coming from a single application. *See* WIPO, 'Part 8 - Terms and Abbreviations concerning Industrial Property Information and Documentation', In: *Handbook On Industrial Property Information and Documentation.* p. 8.1.35, WIPO, (2001), at http://www.wipo.int/standards/en/.

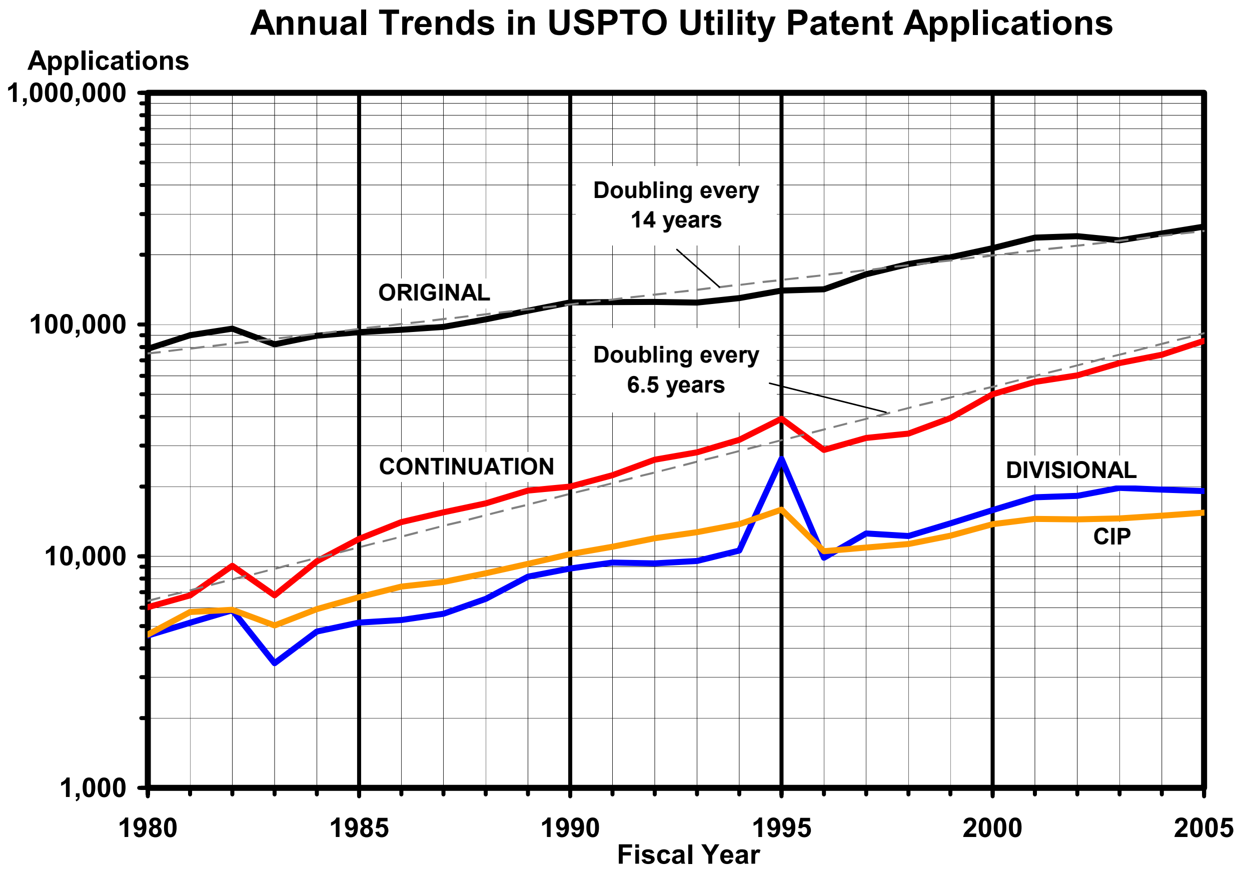

Figure 1. Trends for patent applications by application category. The 'Continuation' category also includes Continued Prosecution Applications (CPAs), Requests for Continued Examination (RCEs) and Rule-129 Continuations. *Source*: Data set from USPTO-FOIA request No. 6-062, December 22, 2005 and USPTO Slides, Mar-29-2006 (See note 40). See numerical data in Appendix A.

Using the resultant data, the number of applications filed with the USPTO each fiscal year[45] since 1980, is shown in Figure 1 for each application type. Note that the vertical axis in the plot is logarithmic, meaning that a straight-line sloping upwards corresponds to an exponential growth in time, with a slope proportional to the growth rate. Several immediate observations can be made with respect to the trends exhibited in Figure 1. First, with the exception of a few disruptive transient events discussed at length below, note that over the last quarter of a century, the average growth in the number of applications in each category is roughly exponential in time. Second, note that the average exponential growth rate for original patent disclosures corresponds to a doubling approximately every 14 years and that the number of continuation applications grows at a higher rate corresponding to doubling every 6.5 years. Figure 1 also shows that CIPs have an average growth rate similar to that of the original applications, as evident from the fact that on average, the trajectories for both types are essentially parallel. It is perhaps not surprising to find similar dynamics in these two types of applications because they both relate to an arrival rate of new inventions and new improvements in related fields. Although **CIP** applications are not counted within the **original** applications category, every **CIP** originates from some **original** application and it has some of the characteristics of an **original** application by its very nature of being a continuation ***In-Part***.

Unlike applications containing newly disclosed inventions, continuations and divisions do not disclose new matter and their sole purpose is limited to amend and/or to present new claims based on previously disclosed matter. As descendents from original applications, continuations and divisions are each

[45] The USPTO fiscal year ends on September 30.

expected to exhibit a growth that is at least proportional to that of original applications. However, for continuations, it appears that the proportionality characteristic does not remain constant. The higher growth rate of continuations is thus related to a persistent historical ***acceleration*** in the proportional rate of the follow-up process. As the curve for continuations in Figure 1 shows, ***this increased propensity over time is not a new trend***. It has been present for a quarter of a century. As discussed in detail below, it is due to fundamental acceleration trends of new product introductions across industries wherein, over time, applicants find increasing need to obtain more continuation claims to cover their products. Had the lifetime characteristics of new products been constant over time, one would expect that the fraction of original applications requiring a follow-up continuation application would remain unchanged, yielding similar growth rates for both types of applications. But as further evidence shown below suggests, product life cycle decreases over time and the growth rate of new product introductions exceeds that of original patent applications. This, in turn, increases over time the relative probability of applicants' need to file continuation applications during the pendency of a prior application in order to protect their inventions.

Divisional applications are a result of the USPTO imposing restrictions on the number of claimed inventions in a single patent. In preserving the unity of invention, the examiners may issue office actions with restrictions on distinct inventive elements. Because applicants introduce such claims both in original applications and in later continuations, it is not surprising to find that the growth rate for the number of divisional applications is somewhere in between that of original applications and that of continuations. Save the brief exceptions of application number transient spikes described below, this trend can be seen in Figure 1 by observing that the slope of an imaginary straight-line describing the long term average trend for divisional applications (not drawn) is steeper than that of original applications and CIPs, but shallower than that of continuations. Before attending to the actual numerical values of the observed growth rates, a slight digression in order to account for the observed historical application number transients of 1982 and 1995 follows.

3.2 Recent historical transients

Figure 1 also shows that at certain times in the past quarter century, the historical exponential growth trends in the annual number of patent applications were disrupted by transients that appear proportionally more pronounced in continuations, CIPs and divisional applications than in original applications. These transients occurred in 1995-1996 and to a lesser degree in 1982-1983. As will be shown below, with high degree of certainty, both of these transients are attributable to extrinsic regulatory changes in 1995 and 1982 respectively that were unrelated to the intrinsic fundamental dynamics of demand for patent protection in the United States.

3.2.1 The transient of 1995

The spike of applications in 1995 had been noted shortly thereafter by John Byrne[46] and more recently by Quillen[47], both attributing it to applicants' rush to file patent applications before the effective date of a law that changed US patent life term. Most recently, Edlyn Simmons[48] has taken a day-by-day closer look at the filing patterns of all patent grants having application dates in 1995 and showed evidence to-the-day, that the application spike is indeed directly caused by the law change in the month of June 1995. However, none of these prior works address the relative difference between transient intensities of original applications and continuations during the transient of '95. Because this distinction is central to the dynamic assessment of continuation applications, and for understanding the effect on measures of patent application activity in subsequent years, it is addressed below.

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[46] J.G. Byrne, Changes on the Frontier of Intellectual Property Law: An Overview of the Changes Required by GATT, *Duquesne Law Review*, **34**, p. 121, (Fall, 1995).
[47] *See* Quillen at al (2002) in note 38.
[48] E.S. Simmons, Trends Disrupted—Patent Information In An Era Of Change. *World Patent Information*, **27**(4), pp. 292-301, (2005).

In December 1994, Congress passed the *Uruguay Round Agreements Act* with several provisions affecting U.S. patent law[49] ("URAA"). Most relevant to this analysis, the URAA changed the term of patent protection from 17 years from the grant date to twenty years from the filing date for applications first filed on or after June 8, 1995. For applications that claim earlier priority, 35 U.S.C. §154(a)(2), as contained in the URAA, provides that if the application contains a specific reference to an earlier application under 35 U.S.C. §120, §121 or §365(c), the patent term will end twenty years from the date on which the ***earliest*** application referred to was filed. Hence claims to earlier priority in new applications ***reduce*** the patent term. However, the 'clock' for any continuation, CIP or divisional application filed ***before*** June 8, 1995 did not get "pulled back" to its earlier priority date. In fact, filing before the June 8th deadline provided applicants with a guarantee of best result. This through a provision of the legislation stating that "the term of a patent that is in force or that results from an application filed [prior to June 8, 1995] shall be ***the greater*** of the 20-year [from filing] term . . . or 17 years from grant term."[50] (Emphasis supplied). Hence, the incentive for filing before the deadline for applicants filing continuations or divisions, who would otherwise have ***reduced*** patent term, was higher than that of applicants filing original applications. As seen below, this motivated many applicants, who relied on an earlier priority date, to accelerate their application work and 'deplete' their pipeline of any applications that they would have otherwise took longer to file.

Analysis of USPTO patent database records on the USPTO web site for all patents filed during 1995 and 1996, and granted as of May 2005, is shown in Figure 2. The distinction between original applications and applications claiming earlier priority of ***any*** type was based on having an earlier case identified in the *Parent Case Identification* field (designated by **PARN** in the USPTO search field). Figure 2 clearly shows the filing spike peaking in June 1995. By analysis of applications filed every day of June 1995, Simmons[48] showed that virtually all applications filed in June 1995 were filed before the June 8 deadline, with several thousands filed on the June 7th deadline[51].

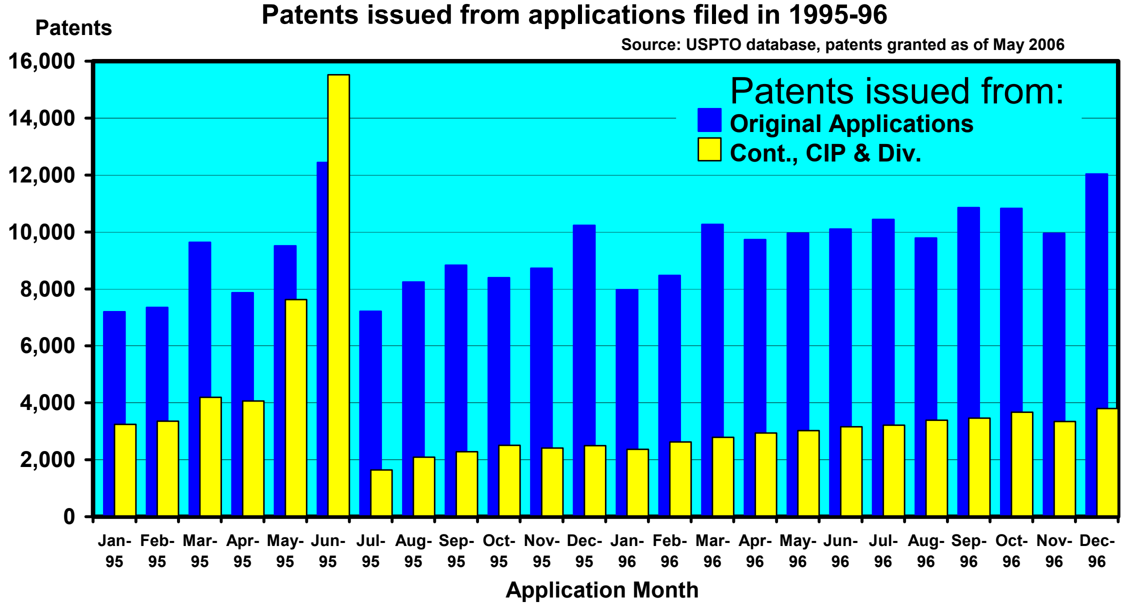
Patents issued from applications filed in 1995-96
Source: USPTO database, patents granted as of May 2006
Patents
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Patents issued from:
Original Applications
Cont., CIP & Div.
Jan-95
Feb-95
Mar-95
Apr-95
May-95
Jun-95
Jul-95
Aug-95
Sep-95
Oct-95
Nov-95
Dec-95
Jan-96
Feb-96
Mar-96
Apr-96
May-96
Jun-96
Jul-96
Aug-96
Sep-96
Oct-96
Nov-96
Dec-96
Application Month

Figure 2. The patent application "Spike& Depletion" of 1995. *Source*: USPTO data, as of May 2006 (see text).

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49 Pub. L. 103-465, Sec. 532(a)(1), 108 Stat. 4983, (Dec. 8, 1994). *See also* K. Tripp and L. Stokley, Changes in the U.S. Patent Law Effected by the Uruguay Round Agreements Act - The GATT Implementation Legislation, *Texas Intellectual Property Journal*, **3**, pp. 315- 342, (1995).

50 35 U.S.C. §154(c)(1), as amended by URAA.

51 An account of the USPTO mailroom including nearby hallways being overwhelmed by a flood of pre-deadline applications at levels never seen before is given by Teresa Riordan, Patents, *N.Y. Times*, June 12, 1995, p. D2.

In contrast with Figure 1 showing all filed applications, Figure 2 shows only applications that ultimately resulted in a patent grant. However, one can see similar overall transient characteristics in both figures for the '95 spike. Figure 2 shows that the spike is pronounced in non-original applications and that the modest spike in original applications seen in the monthly record is all but masked in Figure 1 by the annual cumulative averaging effect of this time scale. Another effect that can be seen in both figures is an effect called here the patent "application inventory depletion", most visible in non-original applications. In particular, the trend of slow recovery in the rate of applications following June 1995 can be seen to extend well into 1996 and beyond. For original applications, this effect is consistent with the observed temporary arrest in the growth of such original applications in 1996. Because non-original applications are derived from original applications filed earlier, incremental changes in their annual count appears to have a two-year lag correlation with changes in original applications, as seen in Figure 1 for the changes during 1996-1998. Figure 1 shows that the spike of '95 had a double and more lasting effect on non-original applications. This is because (a) such applications' inventory "depletion" immediately after '95 was stronger and (b) the temporary lull in increased filing rate of original applications in '96-'97 from which new later non-original applications were derived, attenuated the increase in such non-original applications in later years. For these reasons, this phenomenon is called here the "Spike & Depletion" effect. As further seen in Figure 1, after such effect on the non-original application count subsided, growth trends and annual levels of continuation applications resumed after 1999.

An important distinction is made here between original and non-original applications as pertaining to their emergence from an "inventory" pool of potential applications not yet filed by applicants. This distinction is based on this author's personal experience during that era as inventor, patent prosecutor and intellectual property portfolio manager: The timing of original applications' filing is mostly driven by actual R&D inventive activities and resultant emergence of inventions. These cases involve a rather limited timing control by applicants who wish to preserve their invention priority date. As discussed above, to some extent, these priority preservation dynamics also govern CIP applications. In contrast, a lot more discretion for timing the filing of continuations and divisions is available to applicants because the priority dates for these are already fixed. In the case of divisions pursuant to an examiner restriction, applicants are compelled to elect a subset of claims for initial prosecution. After deciding which set of claims they will retain in prosecution, applicants may often refrain from submitting the other divisional claims right away and may wait for further prosecution advancements in the parent case or for more prior art discovery during foreign prosecution of counterpart applications. This legitimate resource conserving practice clearly contributes to expansion of the "inventory" of applications being held back by applicants. Similar considerations apply to Continuation applications. Based on the time scale involved, it is not unreasonable to expect that at any given time during an equilibrium, such application inventory would normally be worked through over a couple of years. Further evidence that the application spike of '95 in the U.S. was indeed fueled by a release of existing patent application inventory held by applicants rather than by an impulse of new inventions is found by examining the external trends for Canadian inventors filing patent applications in multiple countries at that time. Such application records show that the number of applications filed by Canadian patentees in the U.S. experienced sharp upward transient in 1995 but not in other countries[52]. Had the transient been due to a spur of new Canadian originated inventions, some transient would have been necessarily observed in Canadian originated applications filed in countries other than the U.S.

It is the extraordinary circumstances of a law change in 1995 (and to a lesser extent, that of 1982 discussed below) that caused various patent application "inventories" to deplete precipitously and thus profoundly alter the patent application mix in subsequent years. Unfortunately, patent grants after this ***temporary*** depletion of non-original applications in the mix, were later misinterpreted by certain

[52] N. Gallini, J. Putnam and A. Tepperman, Intellectual Property Rights and the Propensity to Patent, in: *Intellectual Property and Innovation in the Knowledge–Based Economy*, J. Putnam (Ed.), pp. 8.1 – 8.40, Industry Canada, (2001), at http://strategis.ic.gc.ca/epic/internet/inippd-dppi.nsf/en/ip01308e.html, (Figure 2 shows patent applications by Canadian inventors, 1972-97 in the U.S., U.K., Germany and Japan. Sharp upward transient in '95 is observed only in the U.S. curve).

researchers who attributed the observed depleted mix to applicants' change of behavior[53] in response to the law change in 1995. They erroneously concluded that applicants had substantially lower motivation to engage in the practice of filing patent continuations due to this law change, when in fact, the recovery of the growth rate seen in Figure 1 shows no measurable change in that motivation or propensity.

3.2.2 The transient of 1982

In August 1982 Congress enacted legislation[54] authorizing appropriations for the USPTO and raising fees from applicants filing and renewing patents and trademarks. The new law sought to make the USPTO self-funded and thus substantially increased filing and renewal fees for applications filed after 27 August 1982. More importantly, this legislation created separate fee schedules for small and large entities. Filing fees for all entities increased but increases for large entities more than quadrupled under the new law. However, Congress left a short window under which the old fees were in effect and amended 35 U.S.C. §41(a) setting October 1, 1982 as the effective date. This section of the statute also included provisions for increasing the filing fees due to increased complexities presented by certain applications, e.g., applications containing more than a specified number of claims and any application containing a multiply dependent claim. The section also provided that fees will be charged when the number of claims is increased above the specified number or when a multiply dependent claim is first presented, whether on filing or at a later point in processing. Thus, substantial financial incentives were created for applicants to file patent applications of any kind available in their inventory before October 1, 1982, creating the "Spike & Depletion" of 1982 as seen in Figure 3. However, unlike the "Spike & Depletion" of '95, there was no basic difference in the law that caused a relative incentive differential between originally filed applications and continuation applications. This is evident in Figure 3, where the relative rise over the prior background rate is approximately doubled in both application categories. Because virtually all accelerated filings were precisely timed before the end of FY '82 and the depletion effects started only in FY '83, the annual figures for the transient of '82-'83 appear relatively amplified in Figure 1. This essentially shows that a significant inventory of applications that would have normally been filed in FY '83 required only slight time shift advancement for the advantageous filing in FY '82.

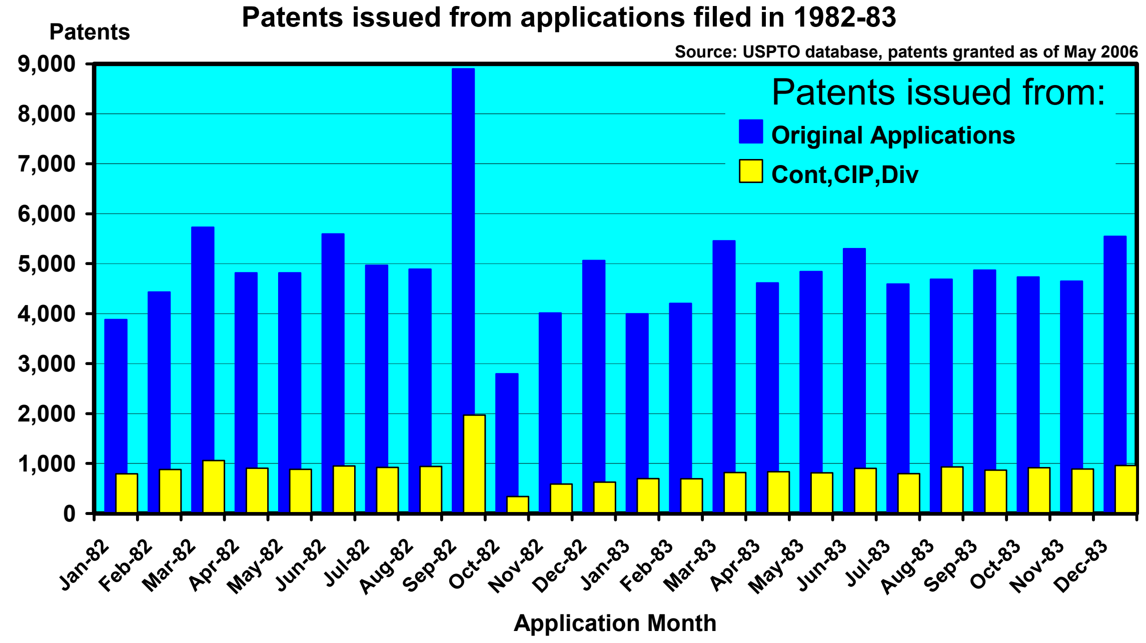
Patents issued from applications filed in 1982-83
Patents
Source: USPTO database, patents granted as of May 2006
Patents issued from:
Original Applications
Cont,CIP,Div
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-82
Feb-82
Mar-82
Apr-82
May-82
Jun-82
Jul-82
Aug-82
Sep-82
Oct-82
Nov-82
Dec-82
Jan-83
Feb-83
Mar-83
Apr-83
May-83
Jun-83
Jul-83
Aug-83
Sep-83
Oct-83
Nov-83
Dec-83
Application Month

Figure 3. The patent application "Spike& Depletion" of 1982. *Source*: USPTO data, as of May 2006 (see text).

[53] *See* Section 4.4.4 below.
[54] P.L. 97–247, §96 Stat. 317, (August 27, 1982).

The substantial fee increases authorized by Congress in the new law of 1982 were also directed to trademarks. The *Trademark Act of 1946*, as amended in 15 U.S.C. §1113 was changed to grant the USPTO discretion to increase trademark fees to a level intended to recover 100% of trademark costs. The increase implemented by the USPTO was substantial. The basic trademark filing fee increased by a factor of five[55] and the incentives to accelerate trademark filing before October 1, 1982 caused a similar spike in such applications, as discussed further below.

4 DISCUSSION AND FURTHER RELATED FINDINGS

Turning back to the patenting trends, the history of patent applications in the USPTO has seen periods of exponential growth with the fastest doubling rates of 6 years during the years 1842-1867, to occasional declines during times of war and recession[56]. More recently, following a period of slow growth prior to 1980, a persistent and faster growth has ensued. Figure 1shows that over the last quarter century, the trend of the number of original patent applications has grown exponentially at an average doubling rate of approximately 14 years. This doubling rate for original patent applications is also equal to the long-term average growth rate of patenting over almost a century, beginning in 1840[57] to 1930. It is noteworthy that the recent exponential growth in the number of such originally disclosed inventions and its characteristic doubling time of 14 years is nearly equal to that of many measures of scientific growth, as can be found in Price's classical work on the exponential growth of science[58]. Therefore, this general growth trend for new patent applications is an expected manifestation of the growth of science and technology and is inherent to the USPTO's role as a recipient and ***publisher***[59] of new scientific knowledge and technological ***disclosures***. There is recent evidence that patent publications constitute an increasing source of first disclosure of new basic scientific information, gradually fulfilling the traditional role of the scientific journal literature[60]. As such, published patent disclosures gradually become integral to the scientific and technical discourse as evidenced by their own increasing use of scientific and technical citations[61]. Like technical and scientific journal papers, the patent disclosures' role as part of the

[55] U.S. General Accounting Office, *Intellectual Property: Fees Are Not Always Commensurate With the Costs of Services*, GAO/RCED-97-113, (May 9, 1997). At http://www.gao.gov/archive/1997/rc97113.pdf .

[56] U.S. Patent Activity for calendar years 1790 to the present. See http://www.uspto.gov/web/offices/ac/ido/oeip/taf/h_counts.htm

[57] 1840 was the first year the USPTO started tracking application count.

[58] D. J. de Solla Price, The Exponential Curve Of Science, *Discovery*, **17**, pp. 240-243, (1956). *See also* his book, (Derek de Solla Price, *Little Science, Big Science*, Columbia University Press, 1963), in which he shows that science's exponential growth over the last three centuries has been astonishingly steady. For example, the doubling time since 1700 in the numbers of founded scientific journals has been around 15 years and, as far as Price could chronicle, the doubling time in the numbers of scientists and engineers has, since 1700, been between 10 and 15 years. Thus, depending on the parameter measured, the scale of the entity we call Science has, over the past three centuries, doubled in size every 10 to 15 years. For a later extensive reviews see also G.N. Gilbert, Measuring The Growth Of Science - A Review Of Indicators Of Scientific Growth, *Scientometrics*, **1(**1), pp. 9-34, (1978); J. Meadows, The Growth Of Journal Literature: A Historical Perspective, In: B. Cronin and H. Barsky-Atkins, (eds.), *The Web of Knowledge: A Festschrift in Honor of Eugene Garfield*, pp. 87-107, American Society for Information Science & Technology Monograph Series, Medford, NJ, (September, 2000),

[59] For many innovators, the USPTO becomes the publisher of choice due to the prior publication bar of 35 U.S.C. § 102(a).

[60] M. Bregonje, Patents: A Unique Source For Scientific Technical Information In Chemistry Related Industry?, *World Patent Information*, **27**(4), pp. 283-368, (2005) (showing that patents' share as a first information source increased over two decades since 1980 at a rate of approximately 8%-10% per decade).

[61] F. Narin, K.S. Hamilton and D. Olivastro, The Increasing Linkage Between U.S. Technology And Public Science, *Research Policy*, **26(**3), pp. 317-330, (October 1997) (showing that references from U.S. patents to U.S.-authored research papers have tripled over a six-year period, from 17,000 during 1987–1988 to 50,000 during 1993–1994, a period in which the U.S. patent system grew by only 30%); Analysis of patents citations of the broader world scientific publications is summarized in: National Science Board, *Science and Engineering Indicators 2006*. Ch. 5, Outputs of S&E Research: Articles and Patents, (2006), at: http://www.nsf.gov/statistics/seind06/c5/c5s3.htm, (showing in Figure 5-58 that U.S. patent citations to science and engineering articles on an average per patent basis rose from 1987 to 2004 by more than a factor of 5).

patentees' bargain with the public for temporary exclusive private right, is to teach new discoveries to the public. It is not surprising to find growth dynamics that roughly conforms to that of science.

Unlike original patent applications from which they originate, continuation patent applications ***do not*** teach or disclose new matter and their arrival rate at the USPTO relates to a different process. The quantity and rate of such non-disclosing applications relate to ***demand for claim protection*** that patentees seek, and this demand need not necessarily arrive at the same rate as that of the underlying disclosures. Rather, demand for claim protection arrives both in originally filed applications and in non-original applications based on market competitive needs. Indeed, apart from the isolated events of Spike & Depletion of 1982 and 1995 as discussed above, Figure 1 shows that the annual count of continuation applications grows exponentially at a faster rate, doubling approximately every 6.5 years. Hence, for reasons that will be discussed below, ***at an ever-increasing rate***, patent applicants do not consider the claims allowed in original patent applications a sufficient and effective ***sole*** appropriation mechanism for their innovations.

This relative disparity between the growth rates of the two application categories is not new. As seen in Figure 1, it has been a prevalent trend for at least a quarter of a century. Clearly, because the continuation applications count grows faster than the original applications count, the time when the former "catches up" with the latter is soon approaching. Thus, what may appear to some observers as only a recent surge in the number of continuation applications is actually a manifestation of a longstanding and fundamental growth phenomenon that has heretofore been unexplained.

Because applications for patent claims are combined from all application types, the composite application growth rate over the last few years has begun to shift towards the higher growth rate that characterizes continuation applications. Several observers have noted this rampant total growth and endeavored to model it and account for it based on various factors such as policy, economics, and R&D investment. Other legal scholars attributed much of the patenting growth to the 1982 establishment of the CAFC, which changed patent law and, according to this theory, generally enhanced the value of patents[62]. A critical analysis of this "patent friendly court" theory is provided in Section 4.4.2. A common observation noted by these and other researchers is that recently, R&D investments in real dollars have not expanded nearly as much as patenting, thereby leading to the conclusion that there had been a perplexing trend in recent years of increased number of issued patents per real R&D dollar. Noting the relatively flat patenting rate prior to the early 80's, these researchers offered various explanatory models for this patenting surge, which they called the "Patent Paradox"[63]. Other explanations for this rapid patenting growth trends were explored by scholars who attributed it, in part, to what they believe to be fundamental faults in the very structure of the U.S. patenting process. They contend that such faults give rise to a surge of low quality patents, suggesting changes or overhaul of the system[64].

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[62] M.J. Adelman, The New World Of Patents Created By The Court Of Appeals For The Federal Circuit, *Journal of Law Reform* **20**(4), pp. 979-1007, (1987) (suggesting that the Court substantially changed the law relating to patent validity and infringement, given substantial guidance on "inequitable conduct" issues, and has "driven terror into the hearts of potential infringers by requiring either that charges of infringement be treated seriously or that compensatory damages be enhanced and attorney fees awarded"); B.H. Hall and R.H. Ziedonis, The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995. *The RAND Journal of Economics*, **32**, pp. 101-125, (2001) (concluding that the strengthening of US patent rights under the CAFC spawned "patent portfolio races" among capital-intensive firms, but also may have facilitated entry by specialized design firms also contributing to increased patenting); Jaffe & Lerner (2004), note 64, (discusses in Ch. 4 how the CAFC has made it easier for applicants to receive patents, patent owners to enforce their patents, courts to uphold patents as valid, and patent owners to receive large monetary awards from infringement, and is thus decidedly pro-patent); J.L. Turner, In Defense of the Patent Friendly Court Hypothesis: Theory and Evidence, (April 2005), *SSRN* at: http://ssrn.com/abstract=713601 (showing that time series of US patent applications, new patent litigations and patent litigation outcomes have significant, synchronized structural breaks, coincident with the establishment of the CAFC in 1982, supporting the "Friendly Court Hypothesis" as the source of the surge in patenting). W.M. Landes and R.A. Posner, An Empirical Analysis of the Patent Court, *University of Chicago Law Review*, **71**, pp. 111-128, (Winter 2004) (asserting that "the [CAFC] has turned out to be a pro-patent court in comparison to the average of the regional courts that it displaced in the patent domain", attributing a significant portion of the growth in patenting to the CAFC).

The difficulty with most of the studies addressing the patent "explosion" or "paradox" is that their pronouncements are mostly based on the ***number of patents*** as a measure for patenting activity. Yet, a critical factor not addressed in these studies is the historical change in other innovation indicators and the ***scope of claims*** in patents or the ***longevity*** of products, methods or processes that these patents are intended to protect. To quantify the changes in the value, scope or breadth of the private property rights conferred by patents, one cannot only use patent counts or the patent quality measures used in the studies cited above. These measures must be augmented by other measures of patent claim scope that are essential for understanding and accounting for the growth trends seen in Figure 1. As will be elaborated below, the ***effective*** growth in patenting is not as dramatic as the number of patents would suggest when one takes into account evidence of gradual erosion of the scope of issued patents and the growth rate of new product introductions. Therefore, in explaining the patenting trends, there is a need to examine the extent to which their legal scope has changed over the years. Possible measures for examining claim scope change are discussed next.

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[63] *See* Hall & Ziedonis (2001) in note 62 above; S. Kortum and J. Lerner, What Is Behind The Recent Surge In Patenting? *Research Policy* **28**, pp. 1–22, (1999) (concluding that the increase in patenting has been driven by changes in the management of innovation, involving a shift to more applied activities.); S. Kortum and J. Lerner, Stronger Protection Or Technological Revolution: What Is Behind The Recent Surge In Patenting?, *Carnegie-Rochester Conference Series on Public Policy*, **48**, pp. 247-304, (1998) (analyzing patent application trends over the world and observing that the surge in patenting is unique to U.S. patentees); A.B. Jaffe, The U.S. Patent System In Transition: Policy Innovation And The Innovation Process, *Research Policy*, **29(**4-5), pp. 531-557, (April 2000) (examining the role of the changes in patent policy during the '80s and '90s and their possible impact on patenting trends); B.H. Hall, Exploring The Patent Explosion, *Journal of Technology Transfer*, **30** (1/2), pp. 35–48, (2005) (exploring various factors and finding that patenting increased in complex product industries and that patents in certain industries are considered necessary to secure financing for industry entry); G. Parchomovsky and R.P. Wagner, Patent Portfolios, *University of Pennsylvania Law Review*, **154**(1), pp. 1-77, (2005) (advancing a theory of patent portfolio holding that the true value of patents inheres not in their individual worth, but in their aggregation into a collection of related patents, motivating firms to increase their patenting activities. See Section 4.4.1); J. Bessen, Patent Thickets: Strategic Patenting of Complex Technologies, Working Paper, (2004), available at http://www.researchoninnovation.org/thicket.pdf. (Firms build "thickets" of patents covering product markets and assert them aggressively. Patentees share rents under cross-licenses, making R&D incentives sub-optimal. Finds that firms license aggressively when patenting standards are low, especially incumbent firms in mature industries).

[64] A.B. Jaffe and J. Lerner, *Innovation and its discontents: How our broken patent system is endangering innovation and progress, and what to do about it*. Princeton University Press, (2004) (arguing that the patent system is not functioning properly and has tipped toward creating and enforcing patent rights that are too strong and may impede innovation. Arguing that validity of patents is upheld too often. Advocating fundamental changes in both the patent office and the legal rules for enforcing patents. But *see also* the review by R.C. Dreyfuss, Pathological Patenting: The PTO As Cause Or Cure, *Michigan Law Review*, **104**(6), pp. 1559-1578, (May 2006) (reviewing Jaffe & Lerner's book) and the critical review of Jaffe & Lerner's book by: T.G. Field, Jr., Patent Medicine, *IpFrontline News*, (June 6, 2006) at http://www.ipfrontline.com/depts/article.asp?id=11255&deptid=8.); S.A. Merrill, R.C. Levin and M.B. Myers, (Eds.), *A Patent System for the 21st Century*. National Academy of Sciences, (2004). Available at http://fermat.nap.edu/html/patentsystem/0309089107.pdf, (advancing seven recommendations for changing the patent system); Lemley & Moore (2004), note 18, (asserting that patent applicants abuse the patent system and suggesting congressional action to limit patent continuations); Anonymous Note, Estopping The Madness At The PTO: Improving Patent Administration Through Prosecution History Estoppel, *Harvard Law Review*, **116(**7), pp. 2164-2185, (May 2003) (asserting that the patent system is at crisis, describing and asserting abuse and proposing prosecution history-based remedies); Quillen (2004) in note 38 (suggesting that Congress abolish the practice of patent continuations); M. Philipp, Patent Filing And Searching: Is Deflation In Quality The Inevitable Consequence Of Hyperinflation In Quantity? *World Patent Information*, **28**, pp. 117–121, (2006) (suggesting that many "doubtful" patent applications are being filed and granted, increasing workload and reducing efficiency, leading to deflation in patent quality). J.R. Thomas, The Responsibility Of The Rulemaker: Comparative Approaches To Patent Administrative Reform, *Berkeley Technology Law Journal*, **17(**2), p. 727, (Spring 2002) (suggesting certain reforms at the USPTO based on experiences of foreign patent offices); *See also* note 9 above citing Government agency sources advocating certain patent reforms.

4.1 Measures for Patent Scope – Can they convey trends for claim scope change?

The shift of effective legal coverage of patent claims granted over the years has received limited attention because it is difficult to measure. The economics of patent scope are rather complex[65]. Although proxies for patent scope and breadth have been suggested and studied extensively, these indicators mostly provide information on the scientific or technological scope of the patent. However, they largely lack a demonstrated relationship to the ***actual legal scope*** of the patent ***claims*** and their capacity to ***protect product variants***. For example, Lanjouw and Schankerman have studied the number of claims in a patent as an indicator of patent strength or breadth[66]. However, the key elements such as ***content and scope*** of each claim remains unaccounted for in this claim counting measure. Lerner[67] used the number of classes that a patent is assigned to by the Patent Office as an indicator of its breadth in covering distinct technology areas. This measure provides no indication as to the strength of any of the patent claims within a technology area. Moreover, while the patent classification system is based on the subject matter claimed in the patent, USPTO examiners' practice is to add cross references to classes of related but ***unclaimed*** subject matter found in the ***disclosure***[68], distancing further such indicator from serving as an effective proxy for the scope and subject matter of the actual patent claims.

Another measure thought to indicate patent scope is the forward citation index based on the number of citations the patent received by subsequent publications. Oppenheim[69] provided extensive review that compared the use of such measures based on citations in scholarly papers to that used in patents. The uses of measures that base the citation index only on the number of citations found in subsequently issued patents are prevalent[70]. A somewhat different forward citation indicator has been devised for patents by Trajtenberg et al[71], by defining a "*generality*" value using the number of classes to which later patents that cite the patent in question were assigned. Thus, under their method, a patent cited by subsequent patents that belong to a wide range of fields, will receive a high numerical generality value, whereas a patent with citations concentrated in only a few fields will receive a low value.

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[65] R.P. Merges and R.R. Nelson, On The Complex Economics Of Patent Scope, *Columbia Law Review*, **90**(4), pp. 839–916, (1990).

[66] J.O. Lanjouw and M. Schankerman The Quality Of Ideas: Measuring Innovation With Multiple Indicators, *NBER* working paper 7345 (1999). Later version published as: J.O. Lanjouw and M, Schankerman, Patent Quality And Research Productivity: Measuring Innovation With Multiple Indicators, *The Economic Journal*, **114**, pp. 441–465, (April, 2004),

[67] J. Lerner, The Importance of Patent Scope: An Empirical Analysis, *The RAND Journal of Economics*, **25**(2), pp. 319-333, (Summer, 1994) (using the number of International Patent Classification designators as a measure of breadth or technology scope).

[68] *See* USPTO, *Examiner Handbook to the U.S. Patent Classification System*, Chapter III, (stating that ***unclaimed*** subject matter characterized as (1) new, (2) uniquely set forth to facilitate recognition, (3) particularly illustrative of significant details or relationships, or (4) providing helpful background or explanatory material, is considered appropriate for classification). At http://www.uspto.gov/web/offices/pac/dapp/sir/co/examhbk/index.htm .

[69] C. Oppenheim, Do Patent Citations Count? In: B. Cronin and H. Barsky-Atkins, (eds.), *The Web of Knowledge: A Festschrift in Honor of Eugene Garfield*, pp. 405-432, American Society for Information Science & Technology Monograph Series, Medford, NJ, (September, 2000) (highlighting the differences in purpose and function between citations in scientific papers and in patents, suggesting extreme caution in interpreting patent citation data).

[70] *See* M. Carpenter, F. Narin, and P. Woolf, Citation Rates to Technologically Important Patents, *World Patent Information* **3**(4), pp. 160-163, (1981) (showing evidence that groups of highly cited patents can provide a valid indication of technical importance); M. Trajtenberg, A Penny For Your Quotes: Patent Citations And The Value Of Innovations, *The RAND Journal of Economics*, **21**(1), pp. 172-187, (1990) (finding that the number of forward citations, weighted by the number of possible citations, correlates positively with the value of a patent); M. Albert, D. Avery, P. McAllister and F. Narin, Direct Validation Of Citation Counts As Indicators Of Industrially Important Patents, *Research Policy*, **20**(3), pp. 251–259, (1991) (establishes an empirical relationship between how many times a patent is cited by later patents and the impact industry experts assign to an invention).

[71] M. Trajtenberg, A.B. Jaffe and R. Henderson, University Versus Corporate Patents: A Window On The Basicness Of Invention, *Economics of Innovation and New Technology*, **5**(1), pp. 19-50, (1997). A bias correction is discussed in Appendix 2 of: B.H. Hall, A.B. Jaffe, M. Trajtenberg, The NBER Patent Citations Data File: Lessons, Insights And Methodological Tools. *NBER*, Working paper No. 8498, (2001), at http://www.nber.org/papers/w8498.

Both of the aforementioned forward patent citation indicators have a common shortcoming as patent claim scope proxies: Scholars using citation statistics are often unaware of the fact that a patent is cited in other patents because of its disclosure and teaching and not because of its claimed invention. Although these forward citation measures may be indicative of the breadth of the patent's ***disclosure*** as a source of prior art, it conveys virtually no legal information about the scope of its ***claims***. If anything, this measure actually provides more information about the scope (or the limitations) of the claims of the subsequent citing patents because the citations were intended by the examiner to limit the scope of claims in these later patents. Thus, the existence of any particular subsequent citation of the focal patent in a later patent depends more directly on what the later patentee attempted to claim and not on the claims that issued in the focal cited patent. More importantly, many patents with the ***highest*** claim strength and value may receive ***no forward citations*** because they are granted from continuation applications. These continuation patents are published later than the original priority application that contains an ***identical*** disclosure. Because patent examiners use disclosures of the ***earliest priority*** as teaching references for citing against newly presented claims, patents that issue from continuations have no examination utility as cited prior art. In contrast, their original application counterparts have earlier publication dates and are therefore of greater utility as cited prior art[72]. Yet, these continuation patents are maintained longer by their owners[73] and are often the most valuable[74] and most sustainable under validity challenges in patent litigation[75]. Apparently, without exception known to this author, all prior authors have been unaware of this 'value inversion' aspect of continuation patents, bringing into question the research conclusions drawn from studies connecting forward citation "strength" with economic value of patents. In summary, while the indicators cited above provide some valuable information on the *scientific* and the *technological* scope of patents, they fall short of being reliable indicators of the *legal* scope of the claims in a patent, much less capable of indicating an historical trend for such scope.

The true scope of a patent claim must also include its ***longevity*** for remaining a valuable exclusive private right. Few patents remain effective appropriation means throughout their statutory life. In recent years only approximately 60% of U.S. patents are renewed after 8 years of life and only approximately 40% after 12 years of life[76]. A patent is renewed if its economic value exceeds its renewal and enforcement cost[77] and the low financial barriers for renewing a patent suggest that its owners are likely to renew it if any of its claims have residual value. So in explaining the rate at which applicants seek to obtain claims on their inventions through continuation applications, one must consider the longevity and relevance over time of the claims they initially receive or hope to receive. As stated above, none of the tools or indicators of patent scope or breadth discussed above could reliably detect historical changes in the actual composite scope of patent claims. However, based on empirical evidence of patent survival analysis discussed in Section 4.2.1 below, certain conclusions regarding these trends can be drawn. These are that patents are gradually issued with diminishing lifetimes, indicating an acceleration of claim obsolescence. As such, patent survival analysis provides a more relevant tool for assessing claim scope trends. In addition, as discussed more fully in Section 4.3, the temporal statistics of court decisions in patent infringement cases can also provide a qualitative indication of the shifts in the breadth of adjudicated patents.

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[72] *See* MPEP § 706.02 (I) - *Choice of prior art; Best available*. (In protecting the public from unwarranted grants of exclusive private rights, examiners are directed to cite most pertinent and ***early*** prior art, less likely to be antedated by a 37 CFR § 1.131 inventor affidavit or declaration of an early invention date).
[73] *See* note 108, discussing evidence that continuation patents are maintained longer by their owners than patents issued from original applications.
[74] J.R. Allison, M.A. Lemley, K.A. Moore, R.D. Trunkey, Valuable Patents, *The Georgetown Law Journals* , **92**(3), p.435-479, (March 2004) (finding that the average size of U.S. patent families in their sample claiming a common priority application is more than 1.22 patents and that in contrast, patents they define as 'valuable patents', were part of a priority family of 1.85 patents on average). Patents issuing from non-original applications are also valuable to their owners for a longer period of time based on their higher renewal rates, as shown by the references in note 108 below.
[75] S.T. Schreiner and P.A. Doody, Patent Contaminations: How Proposed Rule Changes Will Undermine Our System And Create New Problems, *IPL Newsletter*, **24**(2), pp. 38-48,83, (Winter 2006) (At footnote 54, finding based on published 2004 and 2005 CAFC decisions that the percentage of decisions unfavorable to patent validity was about 36.5% for patents issuing from continuation applications versus 41.4 % for patents issued from original applications); V.G. Norton and A.E. Bathke, Effect Of The Proposed PTO Rule Changes On Biotechnology Patents, *San Diego Intellectual Property Law Association*. Attachment in letters to Senators Diane Feinstein and Barbara Boxer, (September 8, 2006) (showing based on 2005 published CAFC decisions that in the biotechnology field, 83.3% of patents issued after more than one continuation were held valid as opposed to only 63.3% otherwise).
[76] USPTO, *2005 Performance and Accountability Report*, at 63. Available at http://www.uspto.gov/web/offices/com/annual/2005/2005annualreport.pdf

It is suggested here that the temporal changes in the scope and longevity of patent claims are major factors in patenting trends. In contrast with previous theories on patenting trends, the data presented in this study suggests that the key antecedents or drivers for the acceleration in patenting, particularly in continuation applications, are the increased rates of new product introductions, the reduction in product lifecycle and the resultant obsolescence of the scope of patent claims.

4.2 Product life cycle reduction and patent claim obsolescence

The increasing resources around the world devoted to scientific and technology research and development naturally leads to a reduction in the time frame for technology changes. Freeman[78] provides an extensive review of the diverse scholarship prior to 1994 addressing the nature and pace of technology changes. A generally held proposition in this area is that the useful primary exploitation lifetime of products and technologies historically shortens as technology advances. The popular literature suggesting that technological changes occur at an ever-increasing rate is not new[79]. Scholarly literature in this area identifies three distinct cycles[80]. The shortest is the "*product life cycle*", the time from concept or initiation of product development through market penetration and eventual decline. The second is a "*generic technology life cycle*" subsuming a number of product life cycles that are typically derived from the same underlying generic or fundamental technology. The third and longest cycle comprise several generations of generic technology life cycles that typically evolve from, and exploit the same underlying set of *basic scientific principles*. The time scales involved in this analysis and its observations are predominantly related to the first level in this hierarchy - the product life cycle. Unlike less frequent Schumpeterian transitions in the cycles of generic technologies that can be abrupt and dislocating for firms and industries[81], transitions in the product cycle level are usually gradual with substantial continuity in the variations of market share of firms and technology stakeholders. It is in the context of the first-level that we look at the period shown in Figure 1. The underlying conceptual premise is that, for a majority of industries, this period that spans a few product life periods is subsumed by only a single generic technology cycle.

[77] A. Pakes, M. Simpson, K. Judd and E. Mansfield, Patent Renewal Data: Comments And Discussion. *Brookings Papers on Economic Activity*, pp. 331-411, (1989). *See also* M.J. Hirabayashi and J.S. Myers, U.S. Patent Expirations Due To The Nonpayment Of The Three And A Half Year Maintenance Fee, *World Patent Information* **10**(3), pp. 191-198, (1988) (showing survey results of factors considered by independent inventors deciding not to renew).
[78] C. Freeman, The Economics Of Technical Change, *Cambridge Journal Of Economics*, **18**(5), pp. 463-514, (Oct 1994).
[79] A. Toffler, *Future Shock*, Random House (1970). *See also*: John Naisbitt, *Mega trends*. Warner Books (1982);
[80] *See e.g.* G. Tassey, *The Economics of R&D Policy*. Quorum Books, (1997) (Chapter 4, at 58).
[81] J. Schumpeter, *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*. McGraw Hill. (1939).

Although the notion of product life cycle shortening has been widely held for some time, actual empirical direct evidence across multiple products was not fully provided until 1981[82]. Life cycle shortening may not occur at every level of the product chain. For example, personal desktop computers contain components such as microprocessors for which, on average, the product life cycle was shown to be shortening[83]. A study of manufacturers that make personal desktop computers found evidence of life cycle reduction for the desktop computer category *across manufacturers*. However, that same study found that product versions *within* some manufacturers evolving product portfolios did not necessarily exhibit evidence of cycle reduction[84]. Despite the fact that certain components within a product chain may not always exhibit cycle time reduction, the overall macro effect across an ensemble of all product component levels and across industries does indeed exhibit a trend of cycle time reduction, as evidenced in national surveys[85].

A significant epoch of the product life cycle is its initial stage of intellectual innovation, new product development and initial market entry. This period in the product life cycle is often called "Time-To-Market", or "Stage 0". Kessler and Chakrabarti[86], and more recently Sheremata[87], reviewed the extensive research on this and other factors governing the speed of innovations. During the last few decades, there has been widespread acceptance in various industries of the desirability of product development cycle time reduction and trends indicate that U.S. companies have managed to reduce product development cycle times substantially. A new-product-development practice survey of companies found that in 1990, new products or major product improvements took an average of 35.5 months to complete (from concept to production), but in 1995 this time had shrunk to 23.8 months[88]. While this dramatic reduction in just 5 years may only represent improvements in companies that have adopted new-product-development quality programs (survey participants), an industry-wide trend in that direction is confirmed by broader studies. In a survey conducted by the National Quality Award Program of the National Institute of Standards and Technology ("NIST"), 79% of responding CEOs cited cycle time reduction as a "major trend" affecting their company[89]. More specifically, Roberts provided evidence in two surveys[90] that during the 1990's actual product time-to-market was reduced worldwide. An exception to this trend is found in some sectors of the biologics and pharmaceutical industry, wherein product development times have risen in the last three decades[91]. See Section 4.2.3.

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[82] W. Qualls, R.W. Olshavsky and R.E. Michaels, Shortening of the PLC: An Empirical Test, *Journal of Marketing*, **45(**4), pp. 76-80, (Autumn, 1981) (showing based on annual sales records of 37 household appliances over a 50 year period that product life cycle (PLC) duration is reduced over time).

[83] A. Aizcorbe and S. Kortum, Moore's Law and the Semiconductor Industry: A Vintage Model, *Scandinavian Journal of Economics*, **107**(4), pp. 603-630, (2005) (*See* Figure 2 showing life cycle and speed trends of Intel's Pentium chips that were introduced during or after 1993 and that subsequently exited the market by 2002).

[84] B.L. Bayus, An Analysis of Product Lifetimes in a Technologically Dynamic Industry, *Management Science*, **44**(6), pp. 763-775, (Jun., 1998).

[85] B. Goldense and J. Gilmore, *GGI 2000 Product Development Metrics Survey - North American Product Portfolio Selection, Management, Strategic Alignment & Success Metrics Practices*, Goldense Group, Inc., Needham, MA (January 1, 2002) (based on 118 responding firms of a national survey conducted in 1999, the mean product life cycle reported was 9.7 years in the primary area of respondent's business. This average figure drops monotonically to 7 years for products in the second through the fourth lines of respondents' business. Importantly, for ***temporal trends***, 60% of companies that track product life cycles reported exclusively decreasing product life cycles, 26% reported stable life cycles, 12% reported a mix of life cycle increases and decreases, and only 4% reported that their product life cycles are exclusively increasing. It should be emphasized that product life cycle defined by companies is the elapsed time from product introduction to its deletion from that company's offering and thus it is shorter than the characteristic product cycle implied in this paper, as the latter begins at conception or patent application and includes product development time.

[86] E.H. Kessler and A.K. Chakrabarti, Innovation Speed: A Conceptual Model of Context, Antecedents, and Outcomes, *Academy of Management Review*, **21**(4), pp. 1143-1191, (Oct., 1996).

[87] W.A. Sheremata, Centrifugal And Centripetal Forces In Radical New Product Development Under Time Pressure, *Academy of Management Review*, **25**(2), pp. 389-408, (2000).

[88] A. Griffin, PDMA Research On New Product Development Practices: Updating Trends And Benchmarking Best Practices, *Journal of Product Innovation Management*, **14(**6), pp. 429-458, (November 1997).

[89] *See* NIST's web site report at http://www.quality.nist.gov/ceo_rpt.htm.

[90] E.B. Roberts, Benchmarking Global Strategic Management Of Technology, *Research Technology Management*, **44(**2), pp. 25-36, (March 2001) (Figure 22 reports changes in time to market between 1991 and 1998 surveys. During these 7 years, in North America, 34% of responding firms have better than halved their product time-to-

A second significant period within the product life cycle of an innovation is the monopoly interval, often referred to as Stage I of the innovation diffusion process[92]. It is the subsequent time to entry of a competing product having similar function, features and use. As a lower bound of product life cycle, the contraction of this period is usually indicative of total product life cycle shrinkage. Agarwal and Gort examined the historical trends of such market entry for innovations in the United States over a period of 100 years. They found that the mean time to competitive entry following launch of innovations sampled across a wide array of industries, decreased monotonically from approximately 33 years to 3.4 years during 100-year period ending on 1986[93]. By citing other studies with findings similar to theirs, they conclude that, overall, this 2.9% per year decrease in the monopoly interval was due primarily to increased mobility of skilled labor, more rapid diffusion of scientific and technical information, more potential entrants (foreign firms), expanding markets and differences in capital costs based on production techniques or patents. These are the same contributing factors to overall product life cycle reduction. The declines reported by Agarwal and Gort for product introductions up to the late 1980's appears to continue in more recent innovation introductions across other products. Bayus et al[94] investigated the personal digital assistant product market in the early 1990's and reported rapid entry of competitors within 2 years of its introduction. DiMasi and Paquette [95] have studied competitive entry times in the pharmaceutical industry and found a rapid decline from an average of 7.2 years in the 1960's to only 1.8 years in the 1995-1999 period. There is evidence that the competitive entry in that industry was remarkably robust, and that subsequent market share gains were even more rapid in the 1990's than in the 1980's[96]. The extent to which there have been changes in barriers to entry for individual industries due to erosion of first-movers' patent protection is not easily ascertained. One must conclude, however, that such patent scope erosion has been a critical factor by the simple fact that the mean time to competitive

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market, 56% have experienced only slight reductions, 8% have seen no change, and only 2% have experienced an increase in their product time-to-market).

[91] J.A. DiMasi, New Drug Development In The United States From 1963 To 1999, *Clinical Pharmacology & Therapeutics*, **69**(5), pp. 286–296, (2001) (showing that total drug development time from synthesis to approval increased from an average of 8.1 years in the 1960's to 14.2 years in the 1990's). *See also* review by M. Dickson and J.P. Gagnon, Key Factors In The Rising Cost Of New Drug Discovery And Development, *Nature Reviews Drug Discovery* **3**, pp. 417-429, (2004).

[92] M. Gort and S. Klepper, Time Paths In The Diffusion Of Product Innovations, *The Economic Journal*, **92**, pp. 630-653, (September 1982) (defining five stages in the diffusion of product innovations and surveying these stages in a sample of 46 innovations).

[93] R. Agarwal, M. Gort, First-Mover Advantage And The Speed Of Competitive Entry, 1887-1986, *Journal Of Law & Economics* **44**(1), pp. 161-177 (2001) (finding in their sample of 46 innovations that the mean time to entry during each 20 year period of commercial introduction reduced as follows: 1887–1906: 32.75 years; 1907–1926: 24.10 years; 1927–1946: 13.84 years; 1947–1966: 5.75 years; 1967–1986: 3.40 years).

[94] B.L. Bayus, S. Jain and A.G. Rao, Too Little, Too Early: Introduction Timing And New Product Performance In The Personal Digital Assistant Industry, *Journal Of Marketing Research*, **34**(1), pp. 50-63, (Feb 1997).

[95] J.A. DiMasi and C. Paquette, The Economics of Follow-on Drug Research and Development - Trends in Entry Rates and the Timing of Development, *Pharmacoeconomics*, **22,** Suppl. 2, pp. 1-14, (2004) (showing that the periods during which first entrants are sheltered from the direct competition that arises when close substitutes in the same drug class are launched have tended to diminish substantially over time. Findings were based on 72 drug classes where the first-in-class compound was approved from 1960 to 1998 and the 235 follow-on drugs for these 72 therapeutic classes that have been approved in the US through 2003. The vast majority of the follow-on drugs for drug classes that were created in the 1990's were in clinical development prior to the approval of the class breakthrough drug, indicating fierce generic drug competition in more recent innovations).

[96] H.G. Grabowski, Patents And New Product Development In The Pharmaceutical And Biotechnology Industries, *Proceedings, Federal Reserve Bank of Dallas*, Sep. Issue, pp. 87-104, (2003) (showing in Figure 2 that one year after generic drug entry, the average unit market share of generics rose from 35% in the mid '80's to 64% in the mid '90's, reaching 73% in the second year after entry).

entry became substantially shorter than the term of patent protection. See the discussion in Section 4.2.3 on patent claim scope erosion.

When new product development time periods and product lifecycles shrink, displacement or obsolescence of existing products in the market is accelerated. Moreover, gradual but appreciable price reductions for a particular product function usually accompanies these cycle reduction trends, enabling the amortization of new products over a shorter period. A contributing factor to such trends is vendors' deletion[97] of older products from their offering upon introduction of new products. Indeed, there is evidence that instances of new product introductions are closely timed with old product deletion from the market[98]. The result is an overall shortening of average product life cycle[99]. If products on average undergo cycle time contraction and are replaced more frequently, the *average age* of products in primary use by consumers must be undergoing reductions too. Thus, one would expect that a larger fraction of corporate sales (or profits) would come from new products, assuming that the time span over which products are considered "new" is defined the same way over the years. Indeed, such trends have been reported by individual companies and more broadly in national surveys[100].

4.2.1 Implications for existing patent claims

There are unavoidable consequences of product cycle reduction trends when it comes to patentees' strategies for protecting their inventions in the market place. As noted above, this cycle reduction implies two related but distinct outcomes. The first is the fact that, at an ever-increasing rate, products are displaced and thus a faster rate of private obsolescence renders a larger fraction of existing patent claims obsolete. Thus, each issued patent claim is gradually worth less privately because the stream of rents it creates declines more quickly, causing a fall in the patent renewal rate. The observed decline in patent renewal rates by Bosworth (UK patents), by Goto & Motohashi (Japanese patents) and by Brown (US patents) is consistent with this hypothesis[101]. Bosworth's data, for example, shows that on average, U.K.

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[97] G.J. Avlonitis, S.J. Hart and N.X. Tzokas, An Analysis Of Product Deletion Scenarios, *Journal of Product Innovation Management*, **17**(1), pp. 41-56, (January 2000) (discussing product deletion as an integral part of the product lifecycle management).

[98] J. Saunders and D. Jobber, Product Replacement: Strategies For Simultaneous Product Deletion And Launch, *Journal of Product Innovation Management*, **11**(5), pp. 433-450, (November 1994) (reporting on a survey with 129 responses from the top 200 USA and British industrial corporations providing data on 194 new product introductions. In the majority of cases (58%) the new and old products sold side-by-side in the same market and only in 13% of the cases the products existed side by side for more than one year.

[99] It is important to note, however, that while life cycles are getting shorter, the magnitude of changes may not necessarily be radical so as to require frequent technological changes. This is because shortening technology life cycles requires raising the assumed discount rates for such R&D investments (particularly for long-term, high risk technology research).

[100] Booz Allen & Hamilton, *New Products Management for the 1980's*, Booz Allen & Hamilton, New York, (1982) (reports on a 1981 survey of 700 *'Fortune-1000'* U.S. companies which indicated that new products introduced in the previous 5 years would, on average, account for 31% of all profits in the period 1981-1986, an increase from about 20% of profits during 1976-1981 from products that were then not older than 5 years. Respondents' median projections for the number of new product introductions during the following five years were double those they introduced in the previous five years); As opposed to the 5 year new product introduction span in Booz Allen & Hamilton's '81 survey, a different survey in which respondents on average defined "new products" as those introduced in the previous 3-year span was compiled by: Goldense & Gilmore, (2002), note 85 above, (annual revenues from new products expressed as a percentage of total annual revenues grew at a rate of 4% per year during the period 1995 - 1999, resulting in 31% by 1999).

[101] D.L. Bosworth, The Rate Of Obsolescence Of Technical Knowledge – A note, *The Journal of Industrial Economics*, **26**(3), pp. 273-279, (March 1978) (finding that British patents granted from 1935 to 1965 had a progressively shorter lifetime corresponding to an annual non-renewal rate from approximately 10%/year to approximately 14%/year respectively); A. Goto and K. Motohashi, Construction of Japanese Patent Database for Research on Japanese patenting activities, *Institute of Intellectual Property*, Tokyo, Japan (2006) at http://www.iip.or.jp/e/patentdb/paper.pdf (showing in Figure 7 that half-life since the application date of Japanese patents having application dates before 1970, during the 1970s and during the 1980s, declined from 17.8 years, to 17 years and to 13.8 years respectively); W.H. Brown, Trends in Patent Renewals at the United States Patent and

patents granted in the 1930's suffered an attrition rate (non-renewal) of 10% per year after their grant while those granted in the 1960's had shorter lifetime with an annual average attrition rate of 14% per year. To be sure, these were rather small average changes for a record of considerable fluctuations and one cannot easily compare lifetimes from different patent offices of different eras. Brown observed such changes in the USPTO at times during which continuations were an insignificant factor in breathing life back into patent applications. His data suggests that U.S. patent attrition for patents granted in 1982 was 17% by the 4th year and 24% by the 8th year after grant whereas patents granted in 1986 had an attrition rate of 21% by the 4th year and 34% by the 8th year after grant. More recent data indicates that there had been a reversal in patent attrition trends at the USPTO[102] but not in other offices.

4.2.2 Implications for new patent claims

A second outcome is applicants' reaction and adaptation of their new claim strategy. As described above, the expected useful life of certain claimed elements in a patent application is shorter for later inventions. Because products and processes become obsolete more quickly, patent holders sometimes need more patent claims to appropriate equivalent returns from their inventions. Thus, the shortening product life cycle and the ever-increasing rate of nascent technology product introductions drive applicants to adopt claim strategies for purposes of (i) product tracking, (ii) early patent protection and (iii) responding to heightened enablement requirements. As explained below, each of these contributes additively to the increase over time in the fraction of original patent applications that require follow-up continuations:

(1) *Product tracking*. As new products are introduced at a progressively faster rate, an ***increasing fraction*** of invention disclosures that have a pending application stand to benefit from "midcourse" claim amendments and additions. This is in order to capture previously unclaimed inventive features or to better match their claims to the evolving features of newly introduced products. At the initial disclosure and presentation of claims, inventors are often unable to anticipate all the parameters of their invention that would be exploited by future product variants. Market uncertainties that patentees face in this regard are by no means subtle and yet they are often overlooked or underestimated by scholars of the patent system. For example, in one out of three new product launches, innovators even fail to predict the upcoming market failures of their own products[103]. In the Pharmaceutical industry only one in 250(!) drugs succeed in reaching the market[104]. In the majority of cases, innovators face specific reactions by competitors[105] that are often unpredictable in substance. Moreover, in cases of market success, there is evidence that about 60% of patented innovations were imitated within four years[106]. These imitations followed leaks of information concerning the detailed nature and operation of the new products or processes, which generally leaked out within about a year[107] from launch. Responses to these

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Trademark Office. *World Patent Information* **17,** pp. 225–234, (1995) (showing that the renewal rate for 4-year old patents declined from 83% to 79% for patents granted in 1982 and 1990 respectively, and that the renewal rate for 8-year old patents gradually declined from 76% to 66% for patents granted in 1982 and 1986 respectively).

[102] Trilateral Patent Offices, *Trilateral Statistical Reports*, 1997-2005 editions. Available at http://www.trilateral.net/tsr (By inspecting the patent half-life, i.e. the 50% survival time, from 1997 through 2005 patent renewals, one finds that the average trend of patent half-life erosion at the EPO, JPO and the USPTO during that period is about 2, 1½ and ¼ years respectively).

[103] Saunders & Jobber (1994), note 98, (indicating that product managers judged as successful only 67% of the new products in the sample of 194 new product introductions).

[104] PhRMA, *Pharmaceutical Industry Profile 2006*, PhRMA, (March 2006), at 4,(showing that only one in 250 drugs that enter the pre-clinical phase ultimately receives FDA approval).

[105] M. Debruyne, M. Rudy, A. Griffin, S. Hart, E.J. Hultink and H. Robben, The Impact Of New Product Launch Strategies On Competitive Reaction In Industrial Markets, *Journal of Product Innovation Management*, **19**(2), pp. 159-170, (March 2002) (finding that two thirds of new product launches meet reaction by competitors after their launch).

[106] E. Mansfield, M. Schwartz and S. Wagner, Imitation Costs And Patents: An Empirical Study, *The Economic Journal*, **91**(364), pp. 907-918, (Dec., 1981).; *See also* notes 93,94 and 95 above.

[107] E. Mansfield, How Rapidly Does New Industrial Technology Leak Out?, *The Journal of Industrial Economics*, **34**(2), pp.217-223, (Dec. 1985).

market events by patent applicants must necessarily be adaptive over several years from the time an innovation is conceived. Amended or added claims in continuation patent applications during prior application pendency often become the legitimate vehicle for applicants' response to product failures and modifications, competitive market reaction, or to imitations by rivals. Evidence that claims initially obtained in original patent applications are later augmented or superseded by claims that better track product features in the market is found in studies that show that patents issued from non-original applications are ultimately maintained longer by their owners[108].

(2) Increasing need for early protection. Because new product introduction times, measured from conception to market entry, are progressively shorter on average, products that require patent protection appear on the market more quickly than thoroughly prosecuted patents can be granted. Hence, an ***increasing fraction*** of patentees are forced to accept only a portion of the claims they submitted in an original application (the claims for which prompt allowance is possible in the early prosecution phase). This practice enables applicants to acquire ***some initial*** patent protection for the products already on the market by letting an original application issue in a ***first*** patent grant having ***reduced claim scope.*** The remaining claims are then pursued in a later continuation application. Splitting claims onto continuations in this manner often results in having fewer claims in continuation patents than other patents for which no claims were split. Because the great majority of patents have no continuations, the empirical finding by Graham[109] that patents granted from continuation applications had fewer claims than patents granted from original applications is consistent with this 'early protection' hypothesis. There is some evidence from new product introduction studies that this 'early protection' practice by applicants was less prevalent several decades ago[110].

(3) Heightened enablement requirement. As the average age of emerging technologies claimed in patents decreases and their use are generally less known, applicants may be finding their claim prosecution at the USPTO more challenging and the resulting exchanges with examiners lengthier. This is due to the shifting (and perhaps diverging) perceptions by applicants and examiners of the heightened standards that must be applied to claim allowance based on the specification. Because emerging technology patents are subject to heightened enablement requirements under 35 U.S.C. §112[111], examiners are directed to apply such heightened scrutiny

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[108] J.A. Barney, A Study Of Patent Mortality Rates Using Statistical Survival Analysis To Rate And Value Patent Assets, *AIPLA Quarterly Journal*, **30**(3), pp. 317-352 (September 2002) (showing that patent maintenance rates generally increase with the number of recorded priorities to related cases. In a sample population of 100,000 Patents granted in 1996, patents that made no priority claim to an earlier filed related case, had an observed fourth-year maintenance rate of 83.1%, compared to 92.4% for patents with five or more related cases, down to 87.8%, for patents with only one related case). *See also* related findings by: K.A. Moore, Worthless Patents, *Berkeley Technology Law Journal*. **20**(4), p.1521, (Fall 2005) (showing in Table 6 that the average number of related applications for patents issued in 1991 and expired at the 4-year, 8-year and 12-year renewal times were 0.27, 0.3, 0.34 respectively and those renewed to full term had 0.38 related applications).

[109] S. J. H. Graham, Ch 3: '*Hiding in the patent's shadow: Firms' uses of secrecy to capture value from new discoveries*' *Continuation,* in Graham's dissertation, note 239, (showing in Section 3.4.3 statistical results for over 500,000 patents issued 1975-1994).

[110] W.S. Comanor and F.M. Scherer, Patent Statistics As A Measure Of Technical Change, *Journal of Political Economy*, **77**(3), pp. 392-398, (May/June 1969) (showing that in the late '50's, product introductions to the market were roughly coincident with their corresponding patent grants).

[111] *Amgen, Inc., v. Chugai Pharmaceutical Co. Ltd.*, 927 F.2d 1200, 59 USLW 2575, 18 U.S.P.Q.2d 1016, Fed.Cir.(Mass.), (Mar 05, 1991) (citing the emerging nature of the technology, pointing to "the structural complexity of the EPO gene, the manifold possibilities for change in its structure, with attendant uncertainty as to what utility will be possessed by these analogs." Thus "It is not sufficient, having made the gene and a handful of analogs whose activity has not been clearly ascertained, to claim all possible genetic sequences that have EPO-like activity"); *Genentech, Inc. v. Novo Nordisk, A/S*, 108 F.3d 1361, 1367-68, Fed.Cir.(N.Y.) (Mar 13, 1997) (requiring a higher standard for enablement when "the claimed invention is the application of an unpredictable technology in the early stages of development"). More recent decisions identify the issue of complexity or uncertainty in the art,

in emerging technology patents[112]. Therefore they are more frequently likely to disagree with the applicant on whether the presented claims are adequately supported by the specification. Exchanges in claim prosecution that ultimately converge on allowed claims in these cases are therefore more likely to extend over continuation applications. This phenomenon is unlikely to be as prevalent in mature technology cases.

Consequently, depending on the field of the invention, a growing number of inventors engage in continued examination practices in order to more effectively protect their inventions embodied in products or processes with shortening lifetimes. Moreover, for the reason identified in factor (1) above and Section 4.2.3, some applicants increase the number of times they file continuation applications per original parent application. It becomes clear that on both counts, ***the rate of continuation applications and the rate of new product introductions are inextricably linked***. It can be shown mathematically that a shortening product life cycle assumption coupled with other basic assumptions, results in a trend for the number of continuation applications per year that grows exponentially. In this context, it can be shown that this growth is at a faster rate than that of original applications, as shown in Figure 1.

For the reasons explained above, it is expected that industry sectors which market products having shorter product life cycle have a higher fraction of patents relying on the continuation process than those of established industry sectors employing mature technologies. Indeed, such patterns were recently reported in a detailed multi-sector analysis of patent continuations[113] and in a general cross industry patent

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as frequent characteristic of claims invalidated on written description grounds. *See Capon v. Eshhar*, 418 F.3d 1349, 1358 (Fed.Cir.2005) ("It is well recognized that in the 'unpredictable' fields of science, it is appropriate to recognize the variability in the science in determining the scope of the coverage to which the inventor is entitled." Also stating that "the determination of what is needed to support generic claims to biological subject matter depends on a variety of factors, such as the existing knowledge in the particular field, the extent and content of the prior art, the maturity of the science or technology, the predictability of the aspect at issue, and other considerations appropriate to the subject matter).

[112] USPTO, *Training Materials For Examining Patent Applications With Respect To 35 U.S.C. Section 112, First Paragraph-Enablement Of Chemical/Biotechnical Applications*, (1996), at http://www.uspto.gov/web/offices/pac/dapp/1pecba.htm, (stating in *II.A.2.b*: "The amount of guidance or direction needed to enable the invention is inversely related to the amount of knowledge in the state of the art as well as the predictability in the art. *In re Fisher*, 427 F.2 833, 839, 166 USPQ 18, 24 (CCPA 1970). The more that is known in the prior art about the nature of the invention, how to make, and how to use the invention, and the more predictable the art is, the less information needs to be explicitly stated in the specification. In contrast, if little is known in the prior art about the nature of the invention and the art is unpredictable, the specification would need more detail as to how to make and use the invention in order to be enabling"); *See also* USPTO, Guidelines for Examination of Patent Applications Under the 35 U.S.C. 112,¶1,''Written Description'' Requirement, **66**(4) *Fed. Reg.* 1099, (January 5, 2001) at http://www.uspto.gov/web/offices/com/sol/notices/writdesguide.pdf.

[113] S. J. H. Graham, 'Patenting In The Shadow Of Secrecy: Innovators' Uses Of U.S. Patent Office Continuation Practice, 1975–2002', Chapter 2 in: *Continuation, Complementarity, and Capturing Value: Three Studies Exploring Firms' Complementary Uses of Appropriability Mechanisms in Technological Innovation*. Ph.D. dissertation, University of California, Berkeley. (2004). (Finding that the continuation shares of issued patents significantly differ among the industry sectors classified as Organic Chemicals, Computing, Electronic Communication, and Combustion Engines. In Figure 2.12 Graham plots these continuation shares for patent grants during 1975-2002, showing that the continuation share diminishes in the aforementioned order of sectors, with the lowest share found in the Combustion Engines sector. This sector has the most mature technology that is less likely characterized by rapid changes and that has been progressing incrementally for over a century – i.e. having the longest product cycle time. *See also* S.J.H. Graham and D.C. Mowery, Submarines In Software? Continuations In US Software Patenting In The 1980s And 1990s. *Economics of Innovation and New Technology*, **13**(5), pp. 443-456, (July 2004); S.J.H. Graham and D.C. Mowery, The Use of USPTO "Continuation" Applications In The Patenting Of Software: Implications For Free And Open Source, *Law & Policy* **27**(1), pp. 128-151, (January 2005), (the latter papers focusing on the software industry, known to have shorter product life cycles, and showing that this sector evolved to have a higher patent continuation share compared to that averaged over all other sectors. These authors' results actually lend more support to the thesis of this paper than to their intended thesis of proving a causal connection of continuations with secrecy motives. See Section 4.4.4).

prosecution study[114]. These results provide further indirect evidence and confirmation for the connection between continuation practice and the rate of new product introductions. Restating these results, it is noted that the propensity to use patent continuations is related the shortening product life ***under patent protection.*** Thus, applicants' patent prosecution is intended to maximize the suitability of their patent claims to the products marketed during the patent protection period. While in most industries product life cycle shrinks at the front end of the patent protection period, in the pharmaceutical industry, product lifetime under patent protection often shrinks at the back-end of the patent term (See Section 4.2.3). In both situations, however, the shrinkage of product lifetime ***under patent protection*** compels these patentees to ensure via continuations that claims drafted at the initial product development stage are properly amended or augmented to better match and cover the final features of the developed products and their variants.

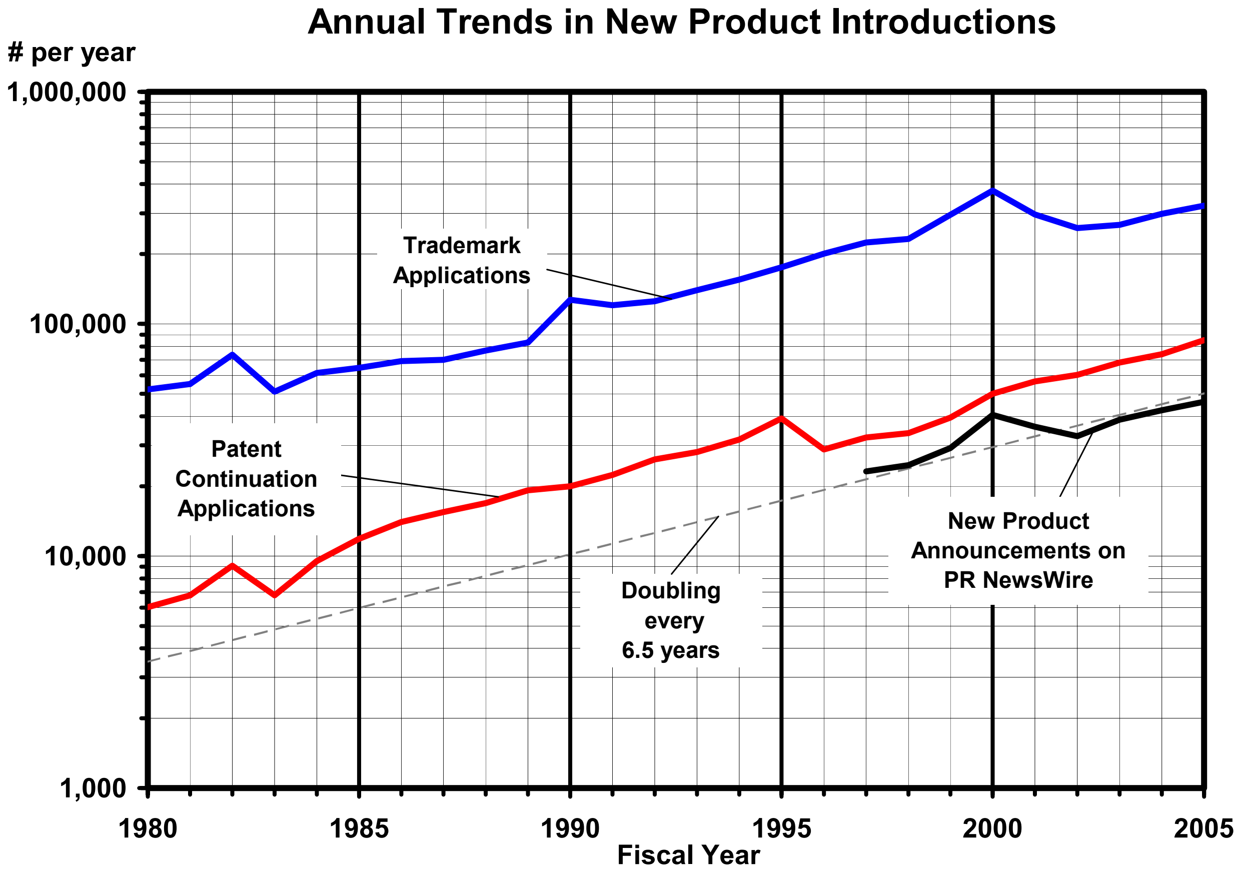

Figure 4. The growth similarity of USPTO applications for patent continuation, trademark registration and the announcements of new products. *Source*: USPTO and PR-Newswire service (see text).

Independent verification of the tight connection between continuation applications and new product introductions can be obtained by examining the historical temporal variation of various proxy indicators for new product introductions. To that end, Figure 4 shows the USPTO patent continuation applications data of Figure 1 superimposed with the annual number of new product announcements as appeared on the

[114] J.R. Allison and M.A. Lemley, Who's Patenting What? An Empirical Exploration of Patent Prosecution, *Vanderbilt Law Review*, **53**, p. 2099, (2000) (reporting at 2154 Table 9 that while the average patent in 1996-1998 issued from 1.50 applications, the sector having the lowest patent to related applications ratio (1.14) was in the most mature technology sector - the automotive related sector, and the sector with the highest ratio (2.38) was the relatively young biotechnology sector).

PR-Newswire service[115]. Although this newswire service carries only a fraction of all news releases issued in the U.S., the ***relative growth*** trends are a relevant indicator of all new product introductions. Unfortunately, data for years earlier than 1997 were not available at PR-Newswire. However the observed growth trend for new product announcements (doubling approximately every 6.5 years) is consistent with information on such trends during prior years, as provided elsewhere[116]. Figure 4 also shows the annual rate of applications for trademark registration at the USPTO[117]. Because new trademark applications are usually connected to new product introductions[118], the ***relative growth*** in the number of such applications is judged an additional relevant proxy for new product introductions.

The following observations can be made with respect to Figure 4: The spike of 1982 is common to both patent continuation and trademark applications because the fee changes in the 1982 law pertained to both types of applications. The incentives that created both spikes have been discussed in Section 3.2.2. The spike of fiscal 1990 is unique to the trademark applications. Prior to that time, a trademark application could not be filed until the mark was first used in interstate commerce. On November 19, 1989, the *Trademark Law Revision Act of 1988*[119] took effect. Under that law, the definition of use in commerce was amended, permitting applicants to file a trademark application under 15 U.S.C. §1051(b) based on a "bona fide" ***intent to use*** the mark, while securing the application date as the priority date. Hence, in November 1989 (FY 1990), many applicants rushed to file in order to obtain an early priority date for their intended mark. The broad peak of the year 2000 is seen to be common to the trademark applications and the new product announcements. It has been suggested that market events at that time show that these anomalies are associated with the “Dot-Com” bubble[120]. It is interesting to note that no discernible peaking occurred at that time in any of the patent application categories. Perhaps this constitutes a proof that the “Dot-Com” exuberance lacked real technological innovative basis, which is why that “bubble” burst.

The fact that the trademark application curve is virtually parallel to the new product announcements curve over the date range of available new product announcement data, suggests that trademark data may indeed serve as a reliable proportional proxy indicator for new product introductions. Thus, apart from the transients discussed above, the remarkably similar slopes that characterize the trends in continuation applications and in new product introduction indicators, strongly suggests a common mechanism for the growth in both activities.

An additional corroboration of the hypothesis holding that increases in the number of continuation patent applications are tightly related to the acceleration of new product introductions can be obtained by examining the implications of, and a corollary to, the ‘Early Protection’ factor (2) listed in page 26 above. If shortening product introduction times compel a growing fraction of patentees to bifurcate prosecution of claims and engage in ‘Early Protection’ practices, then one would expect that the resulting flow of early-allowed issued claims should ***increase*** the fraction of applications that become patent grants with ***some claims***. If, instead, applicants continued to hold-off without bifurcating their claim prosecution or not accepting narrower scope claims, there would be fewer patent applications granted because a larger fraction of applications would be abandoned. Hence, the inevitable corollary to the aforementioned 'Early Protection' factor must be a finding that, on average, the patent grant rate increases over time. Indeed, this was confirmed by a recent analysis of the USPTO patent grant rate undertaken by this author[121], as shown in Figure 5. The grant rate data for later years (not shown) is not fully reflective of the actual grant rate because it is "censored" and disproportionately attenuated due to a progressively larger portion of applications that are still pending final office action. However, it is safe to conclude that in a span of 17 years ending in 1998, the grant rate increased from about 60% to 76%[122]. It is submitted here that this increase in grant rate is less likely due to the relaxation of the USPTO examination rigor nor of its patentability standards but rather an indication of reduced rate of abandonment and the ***reduced scope of allowed claims***, consistent with factor (2) listed in page 26 above. Claims with reduced scope receive higher grant rates under fixed patentability standards. Because an increasing fraction of applicants find it beneficial to bifurcate prosecution and initially "*take what they can get*", they are granted with narrower or fewer claims.

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[115] PR-Newswire service, at http://media.prnewswire.com/en/jsp/main.jsp. The number of press release records under the ‘**New Product/Service’** category for each available fiscal year (October 1 to September 30) was obtained. Data for 1996 was discarded as unreliable due to transitions from the old posting system to Internet based posting system.

[116] R. McKenna, *Real Time: Preparing for the Age of the Never Satisfied Customer*, Harvard Business School Press, (1997) (estimates at page 32 that in 1996, 50,000 new products were announced per year in America, up from only a few thousand annually in 1970. This rate is consistent with doubling every 6.5 years.

[117] USPTO, Trademark applications by fiscal year at http://www.uspto.gov/web/offices/ac/ido/oeip/taf/ann_rpt_intermed.htm

[118] Saunders and Jobber (1994), note 98 above, (finding that brand or trademark names was changed in 47% of instances of new product introductions).

[119] P.L. 100-667, 102 Stat. 3935.

[120] The number of trademark applications reached an all-time high in March 2000, the same month NASDAQ hit its peak. Applications then plummeted by 23 percent from 2000 to 2001, precisely tracking the burst of the dot.com bubble. See http://www.freelancewriting.com/commentary/news-080105-04.html

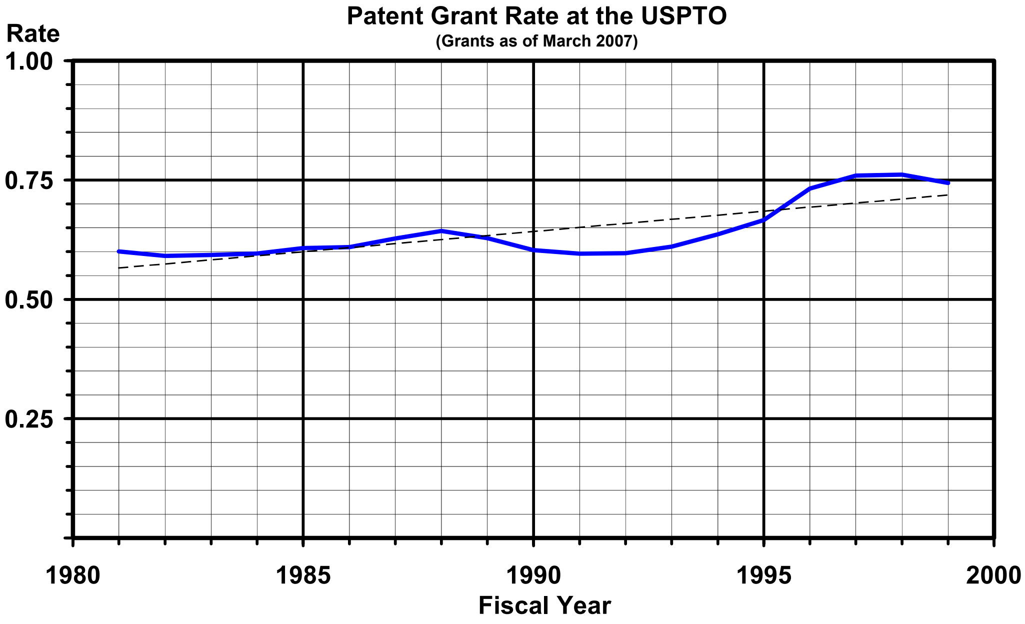

Figure 5. The USPTO patent grant rate by application filing year. Note that the grant rate for applications after1999 are not shown because the results for these years are censored due to a progressively larger portion of applications that are still pending final action. *Source*: Katznelson (2007), note 122, Figure 2.

It is important to note that grant rate increases can be caused by factors other than claim scope reduction. These include deteriorating examination quality (the only factor suggested by the USPTO critics), a shift in patentability standards and the historical increase in the average number of claims at filing[123]. While it is difficult to ascertain the relative contribution of each of these factors to the patent grant rate increases, other independent indicators of gradual patent scope erosion discussed in Section 4.3 strongly suggest that the patent scope narrowing process has been a significant factor in the increased grant rates.

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[121] Katznelson (2007), note 122, Figure 2.

[122] This result is in substantial disagreement with the highly quoted result of Quillen & Webster who suggested that the USPTO's rate of allowing applications in fiscal years 1993–1996 was as high as 95% (see Quillen & Webster (2001), note 38, at 7). Unlike the results of Figure 5 here, Quillen & Webster used an indirect measure based on an assumed two-year prosecution time lag and, more importantly, did not distinguish between original applications and the related continuations for their 95% estimate. In contrast, the results in Figure 5 are based on each and every ***granted*** patent's ***actual*** front-page parameters, indicating it being a grant from an application filed in the ***specified*** fiscal year. In later papers (Quillen et al. (2002, 2006), note 38), these authors provided an additional calculation and corrections (but without correcting a fundamental distortion) deriving an alternate patent allowance rate estimate in the 85% range, still in substantial disagreement with the results in Figure 5. For more detailed account of the common errors in computing and comparing patent grant rates including a review of references discussing the Quillen et al papers and how they were misused by others see R.D. Katznelson, Bad Science in Search of "Bad" Patents, *Federal Circuit Bar Journal*, **17**(1), pp.__, accepted for publication, (August 2007).

In high likelihood, the trend for scope reduction of patents has intensified even more since the 1995 statutory institution of a provisional patent application route[124]. Applicants are entitled to the priority date of a ***provisional*** application in a later non-provisional application that is filed within one year of the provisional application's filing date if the provisional application's disclosure supports the claims[125]. The subsequent prevalent use of provisional applications[126] that enable applicants to establish a priority date and delay by up to one year the filing of claims for examination, often introduces a delay of one year (relative to product introduction) in the first submission and prosecution of claims in a follow-up non-provisional application. Because this postpones filing of initial claims for examination, upon product introduction, some applicants who linger till deadlines have even higher urgency and incentives to obtain some initial protection for their product releases by accepting narrower or fewer claims in a first patent grant within a series. It is expected that over time, the patent grant rate will remain high or will even continue to rise. More importantly, consistent with higher grant rate is the further narrowing of the effective scope of patents, as discussed further in Section 4.3.

4.2.3 The Special Case of Pharmaceutical Patents

The product life cycle factors contributing to the increase in the rate of continuation applications as described above also exist in Pharmaceuticals patenting trends, but their causal effect differs from other industries. The underlying cause, however, is broadly the same. It is the shrinkage of product lifecycle ***under patent protection*** that is generally common to most industries. In other industries, such shrinkage is simply due to product life cycles shrinkage and its subsequent extinction before the statutory life of a patent ends. In the Pharmaceuticals industry, however, such shrinkage typically occurs due to increasing delays in product introductions and the truncation ***at the back-end*** of the patent life due to patent expiry before the product's natural cycle is extinguished. This process results in reduction of product life under patent protection. As mentioned above, average product development and marketing approval time for Pharmaceuticals has increased by more than 6 years in the last four decades, now reaching more than 14 years[91]. Consequently, this trend gradually reduced the effective patent life ("EPL"), defined as the patent term remaining at a product's market launch date. The shrinkage of EPL compels drug patentees to ensure via continuations of pending cases that the claims drafted at the initial drug development stage are properly amended or augmented so as to better track, match, and cover the final features of the developed drug or its close imitations. Unlike other industries where active product life under patent protection follows closer to the initial disclosure and claim drafting, the burden on pharmaceutical patentees to claim foreseeable features and equivalents to those disclosed in their invention 14 years in advance is extraordinary. Thus, the use of continuations, CIPs and divisions is most essential in the pharmaceutical industry and therefore more prevalent than in other industries[127].

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[123] Katznelson (2007), note 122, Section 4, (showing that under fixed patentability standards, patent applications having a larger number of claims are more likely to be granted).

[124] A provisional patent application is a U.S. national application for patent filed under 35 U.S.C. §111(b) and pursuant to 37 C.F.R. §1.53(c), as opposed to a non-provisional patent application, which is a U.S. national application filed under 35 U.S.C. §111(a) and pursuant to 37 C.F.R. §1.53(b). Applicants may use provisional applications to defer patenting decisions.

[125] 35 U.S.C. §119(e).

[126] The filing rate of provisional applications in FY 2005 at the USPTO was 111,753 apps/year, more than doubling the rate of 54,727 apps/year back in 1999. *See* USPTO data source in note 76. Thus, the provisional patent application rate is now nearly 30% of the rate of all other applications, with very little burden on USPTO resources because these are not examined.

[127] Allison & Lemley (2000), note 114 above, (reporting at 2154 Table 9 that while the average patent in 1996-1998 issued from 1.50 applications, the average pharmaceutical patent issued from 2.27 applications and the average biotechnology patent from 2.38 applications).

Back in the 1980's, in response to growing evidence of the historical erosion in EPL and a decline in the number of new drug introductions, Congress enacted the *Drug Price Competition and Patent Term Restoration Act of 1984*[128], also known as the Hatch-Waxman Act. This Act attempts to restore to the patent holder a portion of the patent term lost during the regulatory approval process at the Food and Drug Administration ("FDA"). Significantly, in an effort to balance competing interests, this act also provided for price competition by enabling competing generic drugs to come to market sooner. For the patent term restoration period, a pioneer receives an extension term equal to one-half of the time of the Investigational New Drug ("IND") period. This runs from the time in which a pioneer can begin human clinical trials, plus the New Drug Application ("NDA") period during the NDA review[129]. The maximum extension is five years and the total market exclusivity time cannot exceed fourteen years. The lengths of the statutory exclusive periods appear arbitrary with very little supporting legislative history[130].

Pioneers typically file patent applications sometime during preclinical testing, but well in advance of the IND filing with the FDA[131]. Thus, any delay in the development and approval process reduces the EPL. The Hatch-Waxman patent restoration provisions notwithstanding, studies have shown that the average EPL did not increase but actually continued to shrink[132]. Furthermore, in the last three decades, the pharmaceutical industry has experienced nearly an order of magnitude increase in the average R&D costs for developing new drugs[133], raising the current average costs per drug to the billion-dollar range. These costly R&D investments, normalized by sales revenues, are over five times more than those spent by companies in a composite of all industries[134] and are made under a great deal of uncertainty as to the ultimate success in FDA approval[135]. Even if approved, only 3 out of every 10 marketed drugs produce revenues that match or exceed average R&D costs[136]. The few successful brand drug products face vigorous competition long before patent expiration and arrival of literal copies on the market[137]. In part,

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128 Pub. L. No. 98-417, 98 Stat. 1585 (codified at 15 U.S.C. §§68b-68c, 70b; 21 U.S.C. §§301 note, 355, 360cc; 28 U.S.C. §2201; 35 U.S.C. §§156, 271, 282).

129 35 U.S.C. §156.

130 G.J. Mossinghoff, Overview Of The Hatch-Waxman Act And Its Impact On The Drug Development Process, *Food and Drug Law Journal*, **54**(2), pp. 187-194, (1999),(see Sections I and II for the legislative history of the Hatch-Waxman Act).

131 Mossinghoff (1999), note 130, at Section V.

132 Grabowski (2003), note 96, Figure 7 showing statistical results for 126 new drug introductions in the 1990–1995 period wherein EPL declined from 12.1 years to 11.3, with an average Hatch–Waxman extension of 2.33 years. In the last two years of this period, when virtually all of the drugs involve compounds that entered clinical testing after 1984, the average extension is close to three years in length); S.R. Shulman; J.A. DiMasi; K.I. Kaitin, Patent Term Restoration: The Impact Of The Waxman-Hatch Act On New Drugs And Biologics Approved 1984-1995, *Journal of Biolaw and Business*, **2**(4), pp. 63-68, (1999) (finding that the average effective patent life for new drugs and biologics approved from 1993 to 1995 was 11.2 years with Waxman-Hatch restoration. Without patent term restoration, the average effective patent life for these products would have been only 8.2 years. However, on average, approximately only one-third of the patent term lost during clinical development and regulatory review has been restored by the Waxman-Hatch Act).

133 J. A. DiMasi, R. W. Hansen, and H. G. Grabowski, The Price of Innovation: New Estimates of Drug Development Costs, *Journal of Health Economics* **22**, pp. 151-185, (2003) (showing that the average development costs were $138 M, $318 and $802 M in 1975, 1987 and 2000 respectively). *See also* the review on the rising costs of drug development by Dickson & Gagnon (2004), note 91.

134 R. Levy, The Pharmaceutical Industry: A Discussion Of Competitive And Antitrust Issues In An Environment Of Change, FTC Bureau of Economics Staff Report, (Mar. 1999), at 174-175.

135 *See* PhRMA (2006), note 104, at 4, (Only one in 250 drugs that enter the pre-clinical phase ultimately receives FDA approval).

136 H. Grabowski, J. Vernon, and J. DiMasi, Returns on Research and Development for 1990s New Drug Introductions, *Pharmacoeconomics*, **20**, Suppl. 3, pp. 11-29, (December 2002) (Figure 7, showing a steep distribution of present commercial value (NPV) of new drug introduced in the '90's with the first of 10 having an NPV approximately 5.5 times the average R&D costs, the second of 10 at about 2 times, and the third of 10 at approximately 1.25 times average R&D costs).

137 *See* DiMasi & Paquette (2004), note 95 (reporting on competitive entry times in the pharmaceutical industry and finding such entry exhibited a rapid decline from an average of 7.2 years in the 1960's to only 1.8 years in the 1995-1999 period).

such early competitive entry is encouraged by the Hatch-Waxman Act by providing generic manufacturers the ability to obtain early approval of an Abbreviated New Drug Application ("ANDA") for a generic (but bioequivalent) version of previously approved pioneer drug. Importantly, the first to file such ANDA accompanied with a certification that challenges the patent of the pioneer, is granted 6 months of marketing exclusivity (over other generic manufacturers). As Ludwig et al[138] describe in more detail, this process and the accompanied statutory deadlines for pioneers to respond, effectively puts a bounty on pioneer drug patents and encourages patent litigation. Hence, a legal assault on pharmaceutical pioneers' patents became an essential matter of doing business in the generic drug industry. As compared to all other industries, the number of patent lawsuits per granted patent is highest in the pharmaceutical industry[139].

An additional factor contributing to high patent litigation rates in the pharmaceutical industry is the great investment in, and value of, the underlying technology protected by these patents, often dwarfing the patent litigation costs. With the investment and risk factors described above, this industry must rely heavily on patent protection[140] and therefore appears most diligent in perfecting and matching its patent claims to the market by regular use of continuations, CIPs and divisions[141]. An indication for the resultant value, quality and resilience of the claims that ultimately issue in these pharmaceutical patents is the fact that a larger fraction of these patents are maintained by extension fees through their full statutory term compared to all industries[142]. When such claims are put to the ultimate test in patent litigation, the validity of nearly 73% of pharmaceutical patents were upheld in federal courts upon a challenge as opposed to 54% averaged across all industries[143] in that same period. To a significant degree, the continuation practice enhances patent quality generally and that of pharmaceutical patents in particular. Contrary to the critics' contention that the patent continuation practice results in lower quality "junk"

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138 S. P. Ludwig, K.B. Kosinski, and J. Harris, Hatch-Waxman in the Federal Courts: From 1994–2004, *Drug Development and Industrial Pharmacy*, **31**, pp. 215–222, (2005) (**)

139 J.O. Lanjouw and M. Schankerman , Characteristics of Patent Litigation: A Window on Competition, *The RAND Journal of Economics*, **32(**1), pp. 129-151, (Spring, 2001) (Estimating in Table 1 that the rate of lawsuits filed per patent in connection with patents applied for in 1980-1984 is 2.01% in the pharmaceutical and health product industries and only 1.07% across all industries); Although not strictly comparable due to differing periods, industry and company characteristics, a higher incidence of patent lawsuits per issued patent was reported by: J. Lerner, Patenting in the Shadow of Competitors, *Journal of Law & Economics*, **38**(2), pp. 463-495, (October 1995) (reporting in Table 1 that during 1973-1992, ***new*** biotechnology firms experienced 5.5 patent lawsuits per 100 patent granted during that period).

140 *See e.g*. FTC (2003) at note 9 above, Ch. 3(i): "*Business Testimony: Current Innovation Landscape In Selected Industries*", Summary at 1, ("Pharmaceutical and biotechnology representatives testified that strong patent protection is essential to innovation in their industries. . . . By preventing rival firms from free riding on discoveries, patents allow pharmaceutical firms to recoup the substantial capital investments made to discover, test, and obtain regulatory approval of new drug products. Biotech representatives emphasized that patent protection is critical to attract the capital necessary to fund this high-risk investment. Indeed, firms believed that the biotech industry would not exist but for patents."); *See also*, *id*., Ch. 3(ii) at 223-226 (discussing scholarly speculation that biotechnology patents had produced an "anticommons" and impeded follow-on innovation but noting empirical evidence to the contrary, suggesting that the industry had adapted well to patenting through agreements and business strategies).

141 Allison & Lemley (2000), note 114 above, (reporting at 2154 Table 9 that while the average patent in 1996-1998 issued from 1.50 applications, the average pharmaceutical patent issued from 2.27 applications and the average biotechnology patent from 2.38 applications); Lemley & Moore (2004), note 18 above, (showing in Table 2 that the highest fraction of applications that were continuations, 43%, were examined by the USPTO in the Biotechnology and Organic Chemistry Technology Center).

142 Moore (2005), note 108 above, (studying patents issued in 1991 and showing in Figure 1 that 50% of drug and medical patents are maintained to full statutory term as opposed to an average of 46.3% across all industries shown in Table 1); *See also* Barney (2002), note 108 above, (providing information in Table 2 on a related industry class, Genetic Engineering, showing it has the highest maintenance rate to full term (56%) among six sampled classes).

143 J.R. Allison, M.A. Lemley, Empirical Evidence on the Validity of Litigated Patents, *AIPLA Quarterly Journal*, **26**, pp. 185 (1998) (Studying federal court patent validity decisions from 1989 to 1996 and finding that upon a validity challenge of pharmaceutical patents, the validity of 72.7% were upheld as opposed to 54% for the entire sample across industries.);

patents being asserted in patent infringement suits, actual decision data from the ultimate arbiter of patent quality, the CAFC, suggests that the continuation practice actually results in higher quality patents. Review of recently published CAFC decisions in the biotechnology field shows that the validity of 83.3% of patents issued after ***more than one*** continuation were upheld as opposed to only 63.3% otherwise[144]. A broader study covering CAFC patent decisions in all industries shows that the percentage of decisions unfavorable to patent validity was only 36.5% for patents issuing from any number of continuation applications versus 41.4 % for patents issued from original applications[145].

4.3 The Patent Scope Erosion

An ultimate measure of the scope of a patent is its ability to determine where the patentee's competitors may and may not tread. Indirect evidence that over the years, patent claims must have been subject to gradual decline in their breadth has been discussed in Section 4.2. In that section, macro observations across industries on shortening of competitive entry times to periods much shorter than the patent term were discussed. These competitive entry trends could only occur if patent claims are gradually unable to fend-off competitors. Furthermore, in Section 4.2.2 the claiming strategy shifts in response to acceleration of claim obsolescence have been shown to result in narrower claims. As shown below, additional evidence for this trend can be found in federal court decision statistics for adjudicated patent infringement cases. In order to appreciate that, the correlates and manifestations of claim breadth as expressed in court determination of validity and infringement is addressed below.

A claim drafted to stay clear of the prior art and to better distinguish the particular features of an invention from prior art sources or obvious combination thereof, is inherently narrow enough to withstand invalidity challenges. On the other hand, such narrower claim would be less likely to be infringed or otherwise easier to design-around to avoid infringement. In general, the narrower the claim is drafted, the higher the likelihood that it would be granted in a patent and the higher the likelihood that, if asserted, the courts will uphold its validity. Similarly, patent claims drafted more broadly are more likely to be found infringed but are also more likely to be invalidated by prior art. These facts are often manifested by patentees' attempt to avoid this tension by using split and inconsistent strategies in patent litigation. They argue for a narrow reading of their claim in order to distinguish it from the prior art and later argue a broader interpretation to find infringement by an alleged infringer. This was best captured by an appellate judge paraphrasing an 1886 supreme court decision by stating that: "*A patent may not, like a 'nose of wax', be twisted one way to avoid anticipation and another to find infringement*"[146].

Over the last few decades, the trend in federal court decisions reflects characteristics consistent with a gradual ***narrowing*** of the scope of adjudicated patent claims, increasingly upholding their validity while finding fewer of them being infringed: As of this writing, the most thorough, comprehensive and illuminating study on court decision trends was recently published by Matt Henry and John Turner[147]. Their data shows that the average percentage of decisions finding patents invalid in federal district courts ***declined*** from about 55% during the early 1980's to about 28% in this decade. This shift was accompanied with a concomitant ***increase*** in the percentage of patent decisions finding non-infringement from about 15% to approximately 50% over the same period[148]. Patent decision trends that increasingly uphold the validity of patents while finding fewer of them being infringed has also been observed for that period at the CAFC level[149].

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[144] Norton & Bathke (2006), note 75 above.
[145] Schreiner & Doody (2006), note 75 above.
[146] *Sterner Lighting, Inc. v. Allied Elec. Supply, Inc.*, 431 F.2d 539, 544, 166 U.S.P.Q. (BNA) 454, 459, C.A.Fla., (Aug 5, 1970) (in finding validity but non-infringement, the court stated "A patent may not, like a 'nose of wax', be twisted one way to avoid anticipation and another to find infringement", citing *White v. Dunbar*, 1886, 119 U.S. 47, 51, 7 S.Ct. 72, 74, 30 L.Ed. 303; *Permo Inc. v. Hudson-Ross, Inc.*, 179 F.2d 386, 7th Cir. 1950).
[147] M.D. Henry and J.L. Turner, The Court of Appeals for the Federal Circuit's Impact on Patent Litigation, *Journal of Legal Studies*, **35**, pp. 85-117, (January 2006) (analyzing 50 years of federal court patent decisions).
[148] Henry & Turner (2006), note 147 above, (showing the trends for the share of patent invalidity decisions in Figure 1 and the share of patent non-infringement decisions in Figure 2)

It should be emphasized that the shift of court decision mix that increasingly upholds patents' validity while finding fewer of them infringed can be detected as an average trend even during the six-year period preceding the CAFC establishment in 1982. The percentage of patent decisions finding patents invalid in federal district courts declined from about 63% in 1976 to about 52% in 1981. This shift was accompanied with a concomitant increase in the percentage of patent decisions finding non-infringement from about 11% to approximately 20% during those years[148]. In a similar trend, the data of Henry & Turner suggests that during the same six-year period, the average mix of pre-CAFC appellate court decisions affirming invalidity declined from about 90% in 1976 to about 79% in 1981[150]. Due to the statistically small base and the resulting large fluctuations, the average mix of appellate decisions on infringement in that period cannot be easily discerned as having any statistically significant trend in the Henry & Turner study or the Lunney sub-sampling study. Nevertheless, a decline in the fraction of final decisions affirming patent invalidity can be detected in Lunney's sub-sampling study of pre-CAFC appellate court decisions for that period[151].

Any objective patent adjudication system that is presented with patents having gradually diminishing breadth ***must*** produce these general validity and infringement decision frequency trends. The fact that the courts increasingly uphold the validity of patents has been attributed to the CAFC-era "patent friendly court". However, as noted above, that trend appears to have emerged several years before 1982. Moreover, the increase in the share of court decisions since 1976 finding that patents are not infringed cannot be called "patent friendly". For the term "patent friendly" to be meaningful, an increase in decisions holding patents valid ***and*** infringed must be found. With the exception of a few years after the establishment of the CAFC where indeed such share of decisions had risen[152] (no doubt having led to the term "patent friendly"), the trend for such decisions after the "friendly" transient was actually reversed. The average percentage of decisions holding patents valid ***and*** infringed in federal district courts reduced from about 50% in 1984-85 to an average of only about 10% in this decade[153]. A similar downward trend was also exhibited at the CAFC level[154]. The courts decide on what comes before them and the observed shift in decision mix is inconsistent with the notion that, somehow, the courts have consistently favored the patentee over the alleged infringer.

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149 G.S. Lunney, Patent Law, the Federal Circuit, and the Supreme Court: A Quiet Revolution, *Supreme Court Economic Review*, **11**(1), pp. 1-80, (2003) (Calculations were based on data in Appendix I. Because only final CAFC decisions are dispositive, only the data for patents decided on with finality was used. The non-final decisions cannot be used because it is not clear what "pro-patentee" means vis a vis validity or infringement and because it is unknown how the district court ruled later in such non-final decision cases. Thus, the available data on final decisions in Appendix I indicates that in the years 1984-1985, 31.6% of the CAFC's final decisions held patents in suit invalid and such fraction has gradually declined on average to 19.5% by 2000-2001. On the other hand, during 1984-1985, 21% of the CAFC's final decisions held patents not infringed and that fraction rose gradually on average to 62.6% by 2000-2001).

150 Henry & Turner (2006), note 147 above, (showing trends for AFFIRM share of patent invalidity decisions in Figure 1).

151 Lunney (2003), note 149 above, (calculations based on data in Appendix I show that in the years 1975-1976, 49.1% of the CAFC's final decisions held patents in suit invalid and such fraction has declined to an average of 45.2% during 1981-1982).

152 Henry & Turner (2006), note 147 above, (showing in Figure 3 that the share of patent "Valid and Infringed" decisions has spiked from an average of about 30% in years prior to 1982 to about 59% in 1985, but then generally declining ever since to an average of only about 10% in this decade).

153 Henry & Turner (2006), note 147 above, (showing the trends for the share of patent "valid and Infringed" decisions in Figure 3).

154 Lunney (2003), note 149 above, (calculations based on data in Appendix I show that in the years 1984-1985, 47.4% of the CAFC's final decisions were "a success" for the patentee, holding patents in suit valid ***and*** infringed. Such fraction has gradually declined on average to 21.8% by 2000-2001).

A graphical and more insightful representation of these trends is shown in Figure 6 for patent rulings on patent validity and infringement in U.S. federal district courts from 1975 through 2005. As opposed to representing the fraction of patent decisions in each category, Figure 6 shows independently the sample probability of validity and infringement findings. Court decisions on patent validity and infringement must be presumed ***independent*** decisions based on different and unrelated factors. Validity decisions rest on claim interpretation and the scope of the prior art, which are independent of the accused device. On the other hand, infringement is determined by the extent to which an accused device or method uses or exercises all elements of a valid claim.

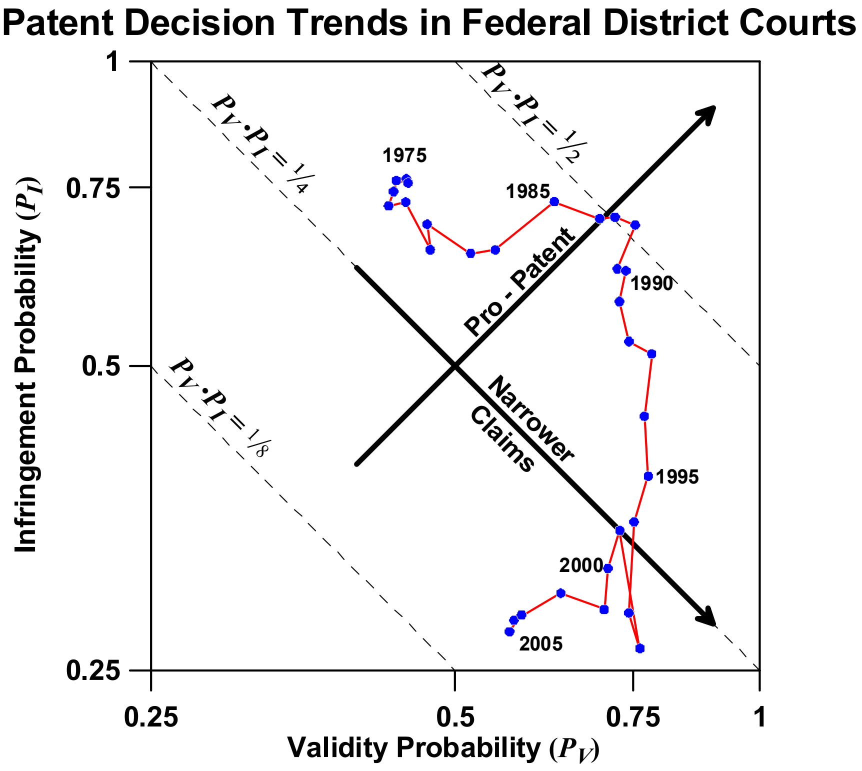

Figure 6. Patent litigation results in all U.S. federal district courts during 1975-2005. Note the overall trend for claim breadth narrowing. The coordinate transformation shown is explained as follows: The diagonal broken lines show the locus of constant patentee success probabilities $P_V \cdot P_I$. In perpendicular, the "Pro-Patent" cardinal direction defines increases in the patentee success probability $P_V \cdot P_I$. A direction neutral to patentee success and orthogonal to the "Pro-Patent" direction is descriptive of claim breadth and is shown as the "Narrower Claims" cardinal direction. A moving average ending at the indicated year is shown in the figure (see text). *Data source*: Henry & Turner (2006), note 147 for 1975-2000 and from *Patstats*[155] for 2001-2005.

For the purposes of Figure 6, the validity probability P_V shown in the horizontal axis is defined as the relative frequency (using the number of patents and not cases) by which patents' validity were upheld in patent validity adjudication during a given period. Similarly, the infringement probability P_I in a period is the ratio between the number of patents held infringed in the period and the total number of patents for which an infringement adjudication was made in the period[156].

[155] *Patstats - U.S. Patent Litigation Statistics,* Institute for Intellectual Property & Information Law at the University of Houston Law Center, (2006) at http://www.patstats.org/editors_page.rev5.html.

[156] For year t, estimates for $P_V(t)$ and $P_I(t)$ were obtained by a moving average that included the prior three years as follows: $P_V(t) = \sum_{k=0}^{k=3} N_V(t-k) / \sum_{k=0}^{k=3} [N_V(t-k) + N_{INV}(t-k)]$ and $P_I(t) = \sum_{k=0}^{k=3} N_{INF}(t-k) / \sum_{k=0}^{k=3} [N_{INF}(t-k) + N_{NINF}(t-k)]$ where the counts N_V, N_{INV}, N_{INF} and N_{NINF} are the number of patents that were found valid, invalid, infringed and non-infringed respectively. For the years up to 2000, Henry & Turner graciously supplied the raw district court decision count data as used in their 2006 paper (note 147). Using the patent counts in each of their three mutually

A new coordinate system having two orthogonal cardinal directions can be identified in Figure 6. Because court decisions on patent validity and on its infringement are independent, in a random ensemble of patents[157], the nominal decision probability of patentee success is equal to the probability of upholding patent validity times the probability that a patent is held infringed, that is, $P_V \bullet P_I$. The locus of points for which $P_V \bullet P_I = constant$, are straight lines in the plot with a slope of –1, as shown by the broken lines of Figure 6. Hence, court decision statistics corresponding to trajectories "moving" along lines of constant nominal patentee success ($P_V \bullet P_I = constant$) are regarded as patentee-neutral. By definition, only "movement" in a direction perpendicular to these broken lines in a manner that increases the product $P_V \bullet P_I$ is a "movement" in the "Pro-Patent" cardinal direction. This cardinal direction is so depicted in the figure. The second independent and orthogonal cardinal direction is therefore along the patentee-neutral direction for which $P_V \bullet P_I = constant$, and in which validity probability is exchanged with infringement probability. Such patentee-neutral exchange can only occur by shifts in the legal breadth of patent claims presented for adjudication. Claims that are more likely to be held valid (higher P_V value) ***and at the same time*** are less likely to be found infringed (lower P_I value), are necessarily narrower claims. This cardinal direction is therefore designated by the "Narrower Claims" direction in Figure 6.

In the context of these two cardinal axes, the plot in Figure 6 shows that, over time, patents involved in unsettled disputes that came before the federal district courts had claims that on average, courts found to be of diminishing scope. While there were definite movements in the pure "Pro-Patent" direction after the establishment of the CAFC in a transient ending in 1985, for the most part, that trend reversed itself shortly thereafter. However, the overall lingering shift over the last thirty years suggests that adjudicated claims were of gradually diminishing scope relative to alleged infringing activities in the market and the available accumulating prior art record.

There is little doubt that the CAFC has made changes in patent law pertaining to doctrines of claim construction and infringement, and thereby altered criteria and standards for determining validity and infringement. The facts shown above suggest that on average, the claims of adjudicated patents are gradually ***held*** to be more narrow, whether such holding is due to intrinsic patent characteristics or due to extrinsic shifts in the legal standards. Arguably, the observed shifts must have been dominated by the intrinsic shifts in claim scope because any extrinsic shifts in legal standards would have already been factored and absorbed by patent litigants in their decisions to proceed or avoid litigation and settle. Although litigated patents are not necessarily representative of all granted patents or even of all those involved in patent disputes, the narrowing shift in their intrinsic claim scope as suggested here is very likely to represent qualitatively similar shifts in the average claim scope of issued patents generally. This lends substantial support for the narrowing claim scope hypothesis, as does the exposition of other evidence and actual mechanisms that produce such claim narrowing effects as described above and as further summarized below.

Bifurcating claim prosecution and initiating a non-original application is necessary where an application faces a restriction requirement, or where an inventor makes an improvement in an invention, or where an applicant and an examiner simply have not had an adequate exchange regarding the issues surrounding

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exclusive categories, the four counts used in the equations above were calculated as follows: N_V = "*Valid & Infringed*"+ "*Not Infringed*"; N_{INV} = "*Invalid*"; N_{INF} = "*Valid & Infringed*"; and N_{NINF} ="*Not Infringed*". For the years 2001-2005, the Patstat data supplied by Paul Janicke (note 155 below) was used as already separately categorized by the four N_V, N_{INV}, N_{INF} and N_{NINF} categories. A slight difference between the Henry & Turner data and that of Patstat should be noted. The Henry & Turner count was ***patent*** based as opposed to ***claims*** based. Thus, Henry & Turner's method considers a patent valid if at least one of its claims was found valid, even if others were found invalid. In contrast, the Patstat method increments separately ***both*** the validity count N_V and the invalidity count N_{INV} based on individual claims' adjudications. This tends to reduce the estimated validity probability, as seen for the years 2001-2005 in the figure. In estimating validity and infringement, any patent decisions on procedural matters or enforceability matters such as inequitable conduct were not included.

[157] Patent disputes reaching litigation are not drawn based on a random selection of patents and may not, in general, exhibit statistical independence between their validity and infringement attributes. However, the *decision* process is presumed independent.

certain claims in an application. The process of finally converging on allowed claims in these non-original applications usually entails a higher likelihood that (a) additional relevant prior art would be brought to the proceedings, narrowing but also strengthening the claims, and that (b) applicants would amend and further direct their claims more specifically toward certain product features that later become known with greater specificity. Thus, while the subject matter claimed in such new patent claims is different from that in the original application, their scope may be more narrowly tailored to newly emerging features. Therefore, they are likely to have improved longevity compared with patents granted from original applications[158]. It turns out that a grant rate analysis up to FY 1997 for all applications as performed by this author, also shows a similar grant rate increase trend[159], although the absolute overall grant rates are usually slightly lower than what Figure 5 shows for original applications. This general increase in patent rate is consistent with a decline of patent scope.

In addition to the mechanisms described above, other legal factors leading to further scope erosion of individual patent claims have recently emerged. Applicants are now more than ever advised to craft a variety of claims, including very narrow claims[160]. Narrow claims have a greater probability of surviving examination with minor or no amendment. Due to evolution of recent legal doctrines, applicants now have a vested interest in minimizing (or making no) claim amendments during prosecution because certain amendments impair their later ability to assert infringement under the judicially created doctrine of equivalents[161]. The result is that on allowance, the claim scope composition within individual patents is skewed towards a greater fraction having narrower claims. Applicants also increase the number of such narrower claims they file in order to preserve their subject matter appropriation goals. Therefore, many such additional claims would most likely be submitted within the growing number of continuation applications.

4.3.1 The benefits of the patent scope erosion

It is difficult to assess the degree to which historical patent scope erosion takes place. However, the evidence discussed above supports the existence of such trend and its relation to product life cycle reduction and acceleration of new product introductions rate. Some patentees compensate for such developments by filing more continuation claims during application pendencies in the first few years of their invention's statutory lifetime. When granted in patents, these claims help track (although more narrowly) the rapidly changing product features that merit ongoing protection, thereby preserving private

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158 As discussed in note 108, patents that claim priority to a parent application have higher survival rates. Thus, there is now evidence that the gradual rise of patent grants from non-original applications-as a fraction of all patent grants is slowly reversing the overall average longevity trends found in the '80s and early '90s and referred to in note 101.

159 Katznnelson (2007), note 122, (showing the USPTO overall grant rate in Figure 2).

160 G.P. Belvis and R.J. Gabric, Drafting Strategies to Maximize Economic Power—"Show Me the Money", *AIPLA Seminar* (2005). At http://www.aipla.org/Content/ContentGroups/Speaker_Papers/Road_Show_Papers/200512/Patent_Prosecution/Belvis-GabricPaper.pdf , (suggesting that a patent should have as many different types of claims as possible and that in addition to broad general claims, there should be several detailed independent claims, sometimes refereed to as picture claims. These claims are narrow in scope, but directly related to the commercial embodiment of the invention and the most likely commercial embodiment of the competition).

161 Patent law has long held that patentees are entitled to an expanded scope of the patent grant beyond the literal reach of the patent claims in certain circumstances. Under the doctrine of equivalents, a patent owner may prevent another from making, selling or using a device that does not literally infringe on the patent claim, but which is only insubstantially different from the claimed invention and is otherwise equivalent in its elements. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 733-735 (2002) (describing the doctrine of equivalence). *See also* Belvis and Gabric (2005), note 160, (suggesting that the best position for a patentee in litigation is to have a narrow, detailed claim with a first office action allowance to assert against a competitor). It should be noted that arguably, applicants' successful attempt to preserve their rights under the doctrine of equivalents, ostensibly broadens the scope of their "narrower" claims. However, there is very little judicial experience in quantifying such prospective broadening, as opposed to the clear and tangible certainty of the *a priory* narrower language of such claims.

rents from previously unclaimed features of the invention. However, as indicated previously, the claim scope of such average patents is likely ***narrower***. Because the statutory period for patent protection is fixed at 20 years from the first priority date, and since product life cycle time shortens, a continuation application with claims for a new product variant has the effect of "breathing new life" to an original application. Therefore, the extended private patent protection period sought in this manner is effectively ***longer*** when measured by ***average product lifetime units***[162]. This effectively results in what some economists call "narrower and longer" patents. Unlike many observations criticizing the U.S. patent system cited in Section 4 above, this author submits that although there is an inevitable growth in the ***number*** of patent applications and subsequent grants, the concomitant emerging phenomenon of narrower patents is generally economically beneficial, advantageous and welcome. This view is based on a body of economic theory that establishes certain optimality conditions for the breadth and duration of exclusive private patent rights. Analytical studies show that when one seeks to maximize the public welfare subject to a constraint of maintaining a fixed private reward to inventors, the maximum public welfare is approached by trading off patent breadth with its term in a manner that grants infinitesimally small breadth to a patent while extending its life[163]. It is also shown in more recent studies that under certain assumptions, this asymptotic solution is also optimal privately[164]. Therefore, approaching this optimal solution preserves the incentives for innovators, minimizes dead weight, and maximizes incentives for future innovations in broader unclaimed fields.

Thus far, this important economically beneficial trend of patent scope erosion eluded intellectual property policy practitioners because, apparently, none have been aware of the patent scope erosion. In fact, an opposite impression due to the deficient "patent friendly court" theory discussed in Section 4.4.2 has been the prevailing view. As stated above, the driving factors propelling this gradual shift in patent scope towards economic optimality are the accelerated rate of new product introductions and reduced product life cycles. Patentees have a significant stake in this development. The ***essential process that facilitates patentees' ability to adapt their patents to this trend is the practice of continuations at the USPTO***. And the ***increased usage of continuations appears to contribute to patent claims having narrower scope and higher quality***.

The United States has a continuing patent application system that has been legally recognized for more than a century and has been protected by statutory provisions that are unique among the major intellectual property granting nations. Legislators in other nations provided that only divisional applications may be filed for distinct inventions subsequent to an original application and thereby foreclosed on applicants' opportunity to obtain continuation or CIP claims in these countries. In contrast, the U.S. continuation and CIP processes facilitate better match between the scope of patent claims and the underlying product life cycle. Therefore, it generally produces more patents per original priority application than in foreign countries. Statistically, the resulting patents have different scope characteristics than those of their foreign counterparts. There is evidence that due to the U.S. continuation and CIP processes, granted U.S. claims for inventions disclosed in a given U.S. priority application are "spread" over more patents and extend over a wider grant date range than those granted in foreign countries[165]. In some cases, certain claims that issue later in the U.S cannot be presented abroad because opportunities to file continuations or CIP's are generally unavailable. The result is that claim portfolios for the same invention disclosures can differ widely within an international family of patent counterparts. U.S. patents likely contain claims that are better matched to actual products and innovations in the market and are therefore more immune to patent lifetime erosion than foreign patents[102]. As the Martha Stewart saying goes, "*It's a good thing***"**. Due to these superior appropriability characteristics, the economic efficiencies and incentives for innovators in the U.S. are enhanced compared to those in foreign countries. This factor augments other quality determinants recognized by a patent protection ranking system that already places the U.S. highest in the world[166]. Any attempt to limit U.S. patentees' rights to file continuations and CIPs will most likely undermine this U.S. advantage.

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[162] Product lifetime essentially defines the economically relevant time unit because the discount rate is most appropriately matched to the depreciation rate associated with such product lifetime. Thus, to the extent an applicant is able to 'extend' the life of a patent within its statutory term by obtaining new claims that cover features of the next product variant, a patent with longer ***effective*** life is thus obtained.

[163] R. Gilbert and C. Shapiro, Optimal Patent Length And Breadth, *The RAND Journal of Economics*, **21**(1), pp. 106-112, (1990) (The optimum scope can intuitively be described as follows: Increasing the breadth of the patent is increasingly costly, in terms of deadweight loss by the public, as the patentee's market power grows. When increasing the length of the patent, by contrast, there is a constant tradeoff between the additional reward to the patentee and the increment to deadweight loss, at least if the underlying environment is stationary. So, in many circumstances, the socially cost-effective way to achieve a given reward to innovators is to have infinitely-lived patents with the minimum market power necessary to attain the required reward level); See also P. Klemperer, How broad should the scope of patent protection be? *The RAND Journal of Economics*, **21**(1), pp. 113-130, (1990) (The presented example of customer tastes shows that a narrow and long patent is optimal). It should be noted that other optimal patent design studies in which patent breadth is not taken as an independent variable or that patent term is not assumed uniform across all patents have been advanced wherein the resultant optimal patent terms are not infinite. However, it can be shown that patent breadth reduction generally benefits public welfare so long as adequate incentives remain vested with the inventor.

[164] T. O'Donoghue, S. Scotchmer and J.F Thisse, Patent Breadth, Patent Life, And The Pace Of Technological Progress. *Journal of Economics & Management Strategy*, **7**(1), pp. 1–32, (Spring 1998). (showing that for leading breadth patents, a policy that produces patent rights with long lives but narrow breadth entail lower private R&D costs).

Contrary to assertions by critics of the US patent system[167], this study makes the case and provides evidence that the overall patenting and innovation trends are inconsistent with patents alleged suppression of downstream innovations or the alleged impediment to technological growth. In this regard, it is important to examine the technological development and innovation trends in foreign countries where continuations and CIPs are unavailable. The critics of the continuation and CIP process have a burden of showing that any of these foreign countries enjoy a market place with less impediments to innovations compared to the U.S.

4.4 Other Theories Of Patenting Trends

Various theories and hypothesis were advanced to account for the patenting trends. The first two subsections below will address proposed theories that are directed towards explaining the general trend of patenting growth at higher rates than that in prior decades. The last two subsections will critically review two theories advanced more particularly to explain the continuation patenting trends.

4.4.1 Patent Portfolio Theory

In a recent paper, Gideon Parchomovsky and Polk Wagner advance a theory of patent portfolios[168] to explain the high growth trends in patenting. They find that the true value of patents lies not in their individual worth, but in their aggregation into a collection of related patents - a patent portfolio. They contend that the explanatory power of their patent portfolio theory allows resolution not only of the patent paradox, but also of many of the otherwise puzzling observable patterns in the modern patenting environment. Parchomovsky and Wagner (hereinafter "P&W") state that under their theory,

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[165] H. Dernis and M. Khan, Triadic Patent Families Methodology, OECD, STI Working Paper 2004/2, (2004), at http://www.olis.oecd.org/olis/2004doc.nsf/linkto/dsti-doc(2004)2, (showing in Figure 5 that for the 1997 priority year, 14% of U.S. patent priorities lead to 2 or more patents while that share is only 5% and 1% for European and Japanese patents respectively. These lower percentages in Europe and Japan are presumably only due to divisional applications). *See also* J.R. Allison and M.A. Lemley, The Growing Complexity of the United States Patent System, *Boston University Law Review*, **82,** pp. 77-144, (2002) (finding that the average total number of U.S. applications in a priority chain, including the one that ultimately resulted in a patent, increased from 1.32 in a 1976-8 patent sample to 1.50 in a 1996-8 sample); Allison et al (March 2004), note 75 (finding that the litigated U.S. patents were part of a priority family of 1.85 patents on average).

[166] J.C. Ginarte and W.G. Park, Determinants Of Patent Rights: A Cross-National Study, *Research Policy*, **26**, pp. 283-301, (1997) (Constructing a composite index of patent rights of a country comprised of elements specific to that country including patent coverage, membership in international patent agreements, possibility of statutory loss of protection, enforcement and duration of patent protection. Shows that the U.S. scores the highest among all 110 countries analyzed).

[167] See generally the assertions made by authors cited in note 64 above.

[168] Parchomovsky & Wagner (2005), note 63.

> "…firms patent heavily to maximize the benefits of patent portfolios, and such benefits are directly determined by the ***quantity*** of patents assembled. In other words, the marginal value of ***increasing*** the size and diversity of the patent portfolio is substantially greater than the marginal value of the individual patent itself. Thus, ***obtaining*** the patent is advantageous even if the value of the individual patent is less than its acquisition cost. Indeed, under this theory, ***patenting decisions*** are essentially unrelated to the value of the individual patent. Instead, the question is whether the additional marginal value of ***adding*** the patent to the portfolio is greater than the acquisition cost."[169] (Emphasis supplied).

P&W's portfolio theory's shortcoming is that it appears to put aside and ignore the actual inventive process by which patents are created. P&W treat the emergence of invention as a mere patenting ***decision*** made by firms that, according to their theory, can ***obtain*** and ***add*** patents in large ***quantity*** thereby ***increasing*** the firm's portfolio size. They attribute the accelerated growth of patenting to an ***economic decision*** by firms that only recently found it advantageous to amass patent portfolios. This section shows that P&W's theory fails to explain and account for the observed patenting growth trends.

From the outset, these authors' analysis of the significant economic advantages of ***organizing*** firms' patent holdings in portfolios is not questioned. Similarly, no criticism is directed here towards their correct analysis of the incentives and the significant attended competitive and licensing advantages of organizing topical patent portfolios in a manner that enhances bargaining power and intellectual property value. Perhaps equally sound, is the authors' thesis that, for patents, the ***organized*** whole (the value of a patent portfolio) is greater than the sum of its ***disorganized*** parts (the value of the individual patents). It is important to note that this present study actually amplifies and lends further support to P&W's presentation of the factors, strategies and economics that benefit firms who ***organize*** their patents (***if issued***) in certain portfolios. However, P&W do not show that these well-documented economic incentives for collecting and organizing patent portfolios are also those that forge the creation of patented inventions. Nor did they identify events or economic environment changes that caused firms to embrace patent portfolio strategies only recently, allegedly causing the patenting growth surge of the late 1980's and the 1990's.

While firms have control over the degree to which they exercise their particular adaptation to patent scope erosion, they cannot just ***will*** inventions to materialize based on an economic ***decision*** to patent. For example, one did not see Dr. Irwin Jacobs, Qualcomm's CEO in the 1980's and 1990's, come to Qualcomm's Design Center Auditorium in San Diego and tell his engineers that Management has made an economic decision to build a powerful patent portfolio and that they should just start inventing much more. Clearly, that is not how Qualcomm developed its large patent portfolio. That portfolio emerged over the years after Qualcomm engineers solved problems, invented and created a whole new wireless industry.

Those who invent, do so when they solve problems. The problems inventors attend to are related to new technologies and new products, and not to new corporate portfolio strategies. Only the solutions that are novel and non-obvious qualify as patentable inventions. Last time this author/inventor received an office action from the USPTO on a patent application, he found that the Office did not abandon its obligation and its vigilance in enforcing the provisions of 35 U.S.C. §102 and §103[170]. Thus, patents are not just created by sending an application to the USPTO and paying the legal fees, as P&W apparently believe. They apparently arrive at such belief by embracing a myth on the high grant rate at the USPTO based in

[169] Parchomovsky & Wagner (2005), note 63, at 42.

[170] The relevant part of 35 U.S.C. § 103(a) reads: "A patent may not be obtained though the invention is not identically disclosed or described as set forth in Section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains".

part on erroneous information[171]. Equally disconnected from the real experience of inventors is their assertion that patents have dubious value, even in the eyes of their owners:

> "all available evidence demonstrates that the average expected value of a patent is extremely small (and ***likely negative*** when acquisition costs are considered): the overwhelming majority of patents have ***no value whatsoever***"[172] (emphasis supplied).

The problem with their presentation is that when attempting to explain applicants' economic considerations made at the time of filing a patent application, P&W use "evidence" of ***ex post*** value estimates[173] and not ***ex ante*** values**,** as perceived by patentees at the time a decision to apply for a patent is made. Hence, P&W adopt an erroneous premise that patentees in some cases know in advance and anticipate such low values as they apply for a patent. P&W imply that applicants generally decide to apply anyway because they calculate that expanding the collections in their patent portfolios, even with worthless patents, generates considerable advantages that go well beyond the aggregated value of each individual patent. However, any serious and close examination of every patent filed will in all likelihood show that, regardless of the ultimate quality of the patent after grant, at the time its inventor(s) file an application, they consider it ***very valuable.*** That is why applicants craft disclosure and specific claims hoping to exclude others. Applicants subsequently file the application by expending resources and prosecution time in an effort to better define the legal boundaries of what they regard as valuable property right. If anything, their resultant actions indicate rather an over-optimistic perception of the value of their inventions[174]. Those who presume otherwise, as P&W appear to, do so at a total disregard of real-world innovation processes that drive and motivate inventors.

When attempting to explain an historical trend, one must also show that specific identifiable events, trends or environmental catalysts had ensued at a particular time, resulting in the observed historical trend or event around that particular time. P&W failed to identify any historical factor or change that altered the desirability of patent portfolios in connection with their theory of patent creation. Many firms knew the advantages of well-coordinated patent portfolios and much of the strategic benefits that P&W describe several decades ago. For example, RCA with its portfolio of radio patents in the 1920s[175] and later AT&T, IBM, Texas Instruments and Hewlett-Packard, were all engaged in sophisticated patent portfolio strategies well before the 1990's[176]. Entire industries had executives who were well aware of these and other firms' beneficial uses of patent portfolios[177]. Why then, did firms not just start building much larger portfolios in these early periods by simply ***willing*** more inventions to be created? Why did the patenting surge have to "wait" for the 1990's? P&W do not identify the factors that facilitated the observed patenting surge and they do not suggest any such factors that ***were not*** present before the 1990's, which otherwise would have caused the patenting surge to occur earlier.

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[171] Parchomovsky & Wagner (2005), note 63, at 21: citing "…the lax and 'patent-friendly' review given by the PTO (which approves ***nearly all*** of the applications that it receives…" (emphasis supplied), and citing in their footnote 76 the erroneous 95% USPTO grant rate from Quillen & Webster's 2001 paper. These authors appear to join others who are intent on ignoring new information showing these errors thereby continuing to propagate old erroneous information on USPTO performance. See note 122.

[172] Parchomovsky & Wagner (2005), note 63, at 5.

[173] Parchomovsky & Wagner (2005), note 63, Table 2 at 17.

[174] F.M. Scherer, The Innovation Lottery, in: R.C. Dreyfuss, D. Leenheer Zimmerman, Harry First (Eds.), *Expanding The Boundaries Of Intellectual Property*: *Innovation Policy for the Knowledge Society***,** pp. 3-21, Oxford University Press, (2001) (describing the excessive optimism among innovators).

[175] W.R. Maclaurin, *Invention and Innovation in the Radio Industry*, Arno Press (1976) (RCA had assembled a portfolio of more than 2,000 patents pertaining to the new field of radio and had an extensive cross-licensing programs in the mid to late 1920's).

[176] P.C. Grindley and D.J. Teece, Managing Intellectual Capital: Licensing And Cross-Licensing In Semiconductors And Electronics, *California Management Review*, **39(** 2), pp. 8-41, (Winter, 1997) (describing the historical portfolio patenting strategies of RCA, AT&T, IBM, TI and HP prior to the 1990's).

[177] C. Boyer, The Power of the Patent Portfolio, *Think Magazine* (IBM), No. 5, pp. 10-11. (1990) (Being a world-class manufacturer and marketer isn't enough. - One needs to own the right to compete through patent portfolios);

Finally, in their section entitled "*Assembling a Patent Portfolio from Alternative Sources: The Case of Gemstar*"[178], P&W describe how Gemstar International Group Ltd., an electronic TV guide company, expanded its patent portfolio by acquiring patents from others. Perhaps without intending to, P&W essentially supply their own example proving that their portfolio theory is flawed as a patent creation theory. According to their patent portfolio theory, Gemstar's own patent portfolio growth could have taken place due to Gemstar's ability to ***decide*** to patent heavily and ***obtain additional*** patents in large quantity thereby increasing its portfolio size. Moreover, according to P&W, the marginal cost for doing so would have been low[179] and Gemstar could have just encouraged and willed its engineers to invent and file new patent applications in the subject matter of interest to Gemstar. According to the portfolio theory, that should have been possible because the USPTO is "patent friendly" and would have granted 95% of Gemstar's expanded portfolio applications[180]. The confluence of only these elements for acquiring new patents is the underlying predicate of P&W's entire patent portfolio thesis. It is clear, however, that this patent acquisition track did not materialize because it could not have. If such patent portfolio expansion were indeed possible, Gemstar would not have had to acquire at great expense ***existing*** patents and applications from other sources.

In fact, Gemstar did not increase its patent portfolio at the average cost of $20,000, as the portfolio theory predicts it could have[181], but did so at far greater costs. For example, based on the available public record[182], Gemstar acquired 13 patents and applications at an average cost of $930,000 per patent on August 16, 1995 by acquiring E-Guide, Inc. for stock[183]. Gemstar also acquired two patents and applications at an average cost of $1.17M per patent on December 12, 1996 by acquiring VideoGuide, Inc. for stock.[184] On May 8, 1997 Gemstar completed the acquisition of 28 patents and applications at an average cost of $9.75M per patent by acquiring Starsight Telecast, Inc. for stock[185]. If Gemstar could have acquired patents it needed for its portfolio for only $20,000 per patent or even ten times that, it would have done so. But it did not because it could not create new patents that cover the basic technology it required for electronic program guides. Such technology was already embodied in existing patents covering inventions of others.

Clearly, P&W's portfolio theory misses the fundamental concept of patent value. Despite having an extensive discussion and elaborate attempts of characterizing the value of patents, P&W fail to mention the single most important determinant of patent value – ***the priority*** of the invention. They fail to consider the fact that ***only one*** party is entitled to exploit certain novel and non-obvious solutions based on ***being first*** to have devised such solutions and that such priority-based exclusive right is the primary source of patent value. The word "priority" does not even appear once in their whole paper. P&W

[178] Parchomovsky & Wagner (2005), note 63, at 50.

[179] Parchomovsky & Wagner (2005), note 63, at 28 including footnote 100, ("..the marginal expected gain in value of adding an additional patent to a well-crafted patent portfolio will almost invariably exceed the marginal cost of acquisition").

[180] See note 171.

[181] Parchomovsky & Wagner (2005), note 63, footnote 100 at 28.

[182] Information on the financial terms of Gemstar's acquisitions identified in this section was obtained from Gemstar's SEC filings: Form DEF14A, Filing Date: Feb-26-1998. The number of patents and applications involved with each of these acquisitions was determined by counting the patents and applications as assigned to the acquired company and/or, assigned later to Gemstar by the acquired company, as of the related acquisition date. Because assignment information on the face of issued patents is often inaccurate and is not updated upon transfer of ownership, patent assignment recordation data was obtained at the USPTO patent assignment web site http://assignments.uspto.gov/assignments/?db=pat .

[183] E-Guide's acquisition was closed shortly before Gemstar's IPO in a stock swap deal giving E-Guide shareholders 3,511,494 shares of Gemstar stock valued at approximately $12M at Gemstar's IPO.

[184] In the acquisition, VideoGuide's shareholders received 475,000 Gemstar shares valued at $2.34M on the closing date.

[185] *See* Communications Daily, **16(**249), P. 6, (December 26, 1996) ("Gemstar, maker of VCR+ automated VCR programming system, agreed to buy StarSight Telecast for stock valued at $273 million, giving StarSight shareholders about 1/3 ownership of Gemstar").

appear to ignore the fact that the costs of alternative non-infringing solutions can be prohibitive and that others cannot traverse the exclusive right by simply filing a later patent application claiming the same or similar subject matter just because they want to expand their portfolio. P&W ignore the simple concept of pioneer timing: Even a firm having the strongest motivation to build a portfolio of patents covering a certain subject matter of interest, cannot change past activities of other inventors or, for that matter, reorder the ***priority dates*** for its benefit. The fact that the value of a patent is dominated by its invention's priority date was best stated by Gemstar in a press release issued upon acquiring a couple of patents from Michael Levine, an individual inventor. Gemstar stated that "*The early filing date of 1981 and the extent of its claims, combine to give the '815 patent and its related patents … broad coverage in the area of interactive program guides*" [186]. Patented inventions are not works of art that can be created at will without regard to priority (even by the same artists) and placed in an ever-expanding art portfolio, as the patent portfolio theory appears to surmise. That is why inventions are not protected by copyright law but rather by patent law. When tested on Gemstar, a firm that was clearly motivated to expand its portfolio, P&W's portfolio theory fails. A theory that properly explains the growth of patenting must necessarily explain the growth in the ***total*** number of patents at the USPTO and not only the growth of ***a particular*** firm's portfolio at the expense of others' portfolios.

By simply stating the advantages of organizing the greater numbers of acquired patents in portfolios, P&W do not establish the ***causal*** antecedent connection between a firm's decision to create or expand its patent portfolio and the required changes in its employees' ***propensity*** to solve more problems and ***invent*** more. P&W's theory does not explain the specific numerical ***growth rate*** of the observed number of patent portfolios or their sizes. So, for example, it is unclear why (according to the portfolio theory) would patent applications filed in order to expand patent portfolios follow the specific observed numerical growth rate shown in Figure 1, or why the observed rate is approximately equal to that of new product introductions and not faster or slower than that. In contrast, this author's present study shows and explains the numerical growth rate in patenting due to fundamental trends of patentable products, which are shown to occur regardless of patent portfolio structures. It is now clear that P&W's patent portfolio theory may be an excellent patent ***organization*** theory – but a patent ***creation*** theory - it is not. Therefore, its authors' conclusion that it resolves the "patent paradox"[187] is simply wrong.

4.4.2 The "Patent-Friendly Court" Theory and the Patenting Surge.

The theory holding that the establishment of the CAFC in 1982 and its subsequent jurisprudential behavior was the primary cause for the patenting surge that followed the mid 1980's is the "patent friendly court" theory. It appears to be widely held mostly by observers who are intimately familiar with patent law. They attribute much import and significance to the CAFC doctrinal changes in patent law as the primary catalysts to a private economic behavior - increased patenting propensity.[188] To be sure, other competing theories have been advanced, and in particular by those having intimate familiarity with fields other than patent law. Some economics scholars reject the "patent friendly court" hypothesis and argue that a simultaneous surge in the productivity of research and development and related management of resources towards innovation is the primary force behind the surge in patenting[189]. Yet, others contend that firms' tendency to create and expand patent portfolios is the primary cause for the observed surge[190]. Although the patent friendly court theory has received more attention and preference in the patent literature, evidence is at best scant to suggest that innovators and inventors actually consider the results of the legal changes promulgated by the CAFC when they decide to apply for patents. This section provides some critical treatment of the patent friendly court theory, suggesting based on the results of this study and other evidence, that it is inconsistent with the diverse evidence surrounding the observed patenting growth.

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[186] Gemstar's news release on Business Wire, *Gemstar International Group Ltd Expands Its Intellectual Property Portfolio in the Field of Electronic Television Guides*, (October 28, 1997) (Upon mentioning Levine's US Patent No. 5,508,815 as being acquired, Gemstar said: "The early filing date of 1981 and the extent of its claims, combine to give the '815 patent and its related patents, such as U.S. Patent No. 4,908,713 (Michael R. Levine, inventor), broad coverage in the area of interactive program guides").
[187] Parchomovsky & Wagner (2005), note 63, at 51-53.
[188] See the references cited in note 62 above.
[189] Kortum & Lerner, (1998,1999) at note 63 above.
[190] Parchomovsky & Wagner (2005), note 63 above, but see a critical analysis of the patent portfolio theory in Section 4.4.1.

As stated earlier, there is very little doubt that the CAFC has had a profound effect on patent law and that it changed the legal doctrines for determining patent validity and infringement[191]. Moreover, substantial evidence exists suggesting that a marked change in the statistical mix of federal district and appellate courts' patent decisions have taken place in close temporal coincidence with the establishment of the CAFC in 1982[192]. However, the 'patent friendly' transient that appeared immediately after 1982[193] was not a sustained trend and as discussed in Section 4.3 above, subsequent changes in decision trends were not necessarily 'patent friendly' but merely indicative of the courts' finding adjudicated patent claims to be of diminishing breadth on average. The very threshold presumption holding that the CAFC ushered-in a ***sustained*** period of "patent friendly" environment that caused inventors to become more inclined to file patent applications and patentees to became more inclined to pursue patent infringement lawsuits against their rivals is questioned. But even if one accepts the fact that patent adjudications were friendly to patentees, it does not mean that their actions for procuring patents have changed materially in view of the following factual barriers for accepting this hypothesis:

The underlying premise of the patent friendly court theory is that the value of a patent stems from only the appropriable rents created by the patent's exclusive property rights over related technologies and product markets. As a result, the fraction of inventions for which patent protection is sought must depend on the prevailing legal strength of patents. When such strength is enhanced, so is the rate of patent applications and patent lawsuits. Thus, this theory predicts a contemporaneous break in the trends for these time series and the emergence of the CAFC. Upon close examination of the records of such time series, no significant deviations from the growth trends prevailing a few years ***before*** 1982 can be discerned. The growth rate of all patent application types shown in Figure 1 exhibit a similar upward sloping trend ***before*** and ***after*** 1982, with the exception of the 'spike' of 1982 and the 'depletion' of 1983. The precise timing and cause of the 'spike and depletion' of 82' was due to substantial filing cost increases discussed in Section 3.2.2 and not due to the establishment of the CAFC. This observation is contrary to Turner's structural break regression analysis[194], which found that a break in application growth trends occurred in 1982. In fact, Turner's own patent application data in his Figure 1 is inconsistent with his 1982 break conclusion, as it clearly shows that the departure from several years of flat constant application rate during the 1970's, occurred in 1979, subsequent to which that steady growth trend continued into the '80's[195]. Given his patent friendly cause premise, Turner's finding of a patent application break in 1982 is also inconsistent with his own finding that the legal impact of the CAFC did not become apparent in its decisions until 1983, the year Turner finds the structural break in CAFC validity decisions. What then has prompted applicants break from their application patterns a year earlier according to Turner? Clearly, the increased propensity over each preceding year to file patent applications in 1980, 1981 and 1982 (in a way that differed substantially from the trends of the 70's) could not have been due to applicants' anticipation of a future 'patent friendly' CAFC.

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[191] P.M. Janicke, To Be Or Not To Be: The Long Gestation of the Court of Appeals for the Federal Circuit, *Antitrust Law Journal*, **69**(3), pp. 645-667, (2002) (describes the legislative efforts to create a single national court for patent appeals, creating in 1982 the court of specialized jurisdiction on patents. Showing that since the creation of the CAFC the Supreme Court has basically left the new court unimpeded in restating patent law doctrine on the subjects that had caused the most analytical difficulty. Concludes that, for the most part, the CAFC was successful in achieving the intended elimination of inconsistent results in the regional courts of appeal); R.C. Dreyfuss, The Federal Circuit: A Case Study in Specialized Courts, *New York University Law Review*, **64**(1), pp. 1–74, (1989) (studying the CAFC's first years and their effect on patent doctrines and proposing adjustments); R.C. Dreyfuss, The Federal Circuit: A Continuing Experiment In Specialization, *Case Western Reserve Law Review*, **54**, pp. 769-801, (2004) (reviewing more recent judicial and administrative trends at the CAFC and providing an extensive review of the literature on the CAFC); R.P. Wagner and L. Petherbridge, Is the Federal Circuit Succeeding: An Empirical Assessment of Judicial Performance, *University of Pennsylvania Law Review*, **152**, pp. 1105 (2004) (Examines the CAFC's doctrines of claim construction using empirical historical decisions data and concludes that two distinct methodological approaches were prevalent, procedure and holistic, leading to distinct results); R.P. Wagner and L. Petherbridge , The Federal Circuit And Patentability: An Empirical Assessment Of The Law Of Obviousness, *Texas Law Review*, **85,** __, (2007) (examines the CAFC's doctrine of obviousness. Based on empirical decisions data spanning more than fifteen years, suggesting that the CAFC has developed a doctrine in the area of obviousness that is relatively stable and appears reasonably predictable).

[192] Henry & Turner (2006), note 147 above, (showing in Figures 1 through 3 a marked break after 1982 in the share of patent validity and infringement decisions at the federal district court level and their affirmation rates at the appellate level); Lunney (2003), note 149 above, (showing in Figures 2 and 3 a marked break around 1982 in appellate decisions affecting the final success of a patentee in validity and infringement determinations. While after 1982, patentees were more likely to succeed on validity determinations compared to prior years, they were also more likely to fail on infringement determinations compared to prior years).

[193] *See* note 152above and Figure 6.

Some proponents of the "friendly court" theory point to what they call "the patent litigation ***explosion***"[196] that followed the establishment of the CAFC. Merz and Nicholas[197] as well as Turner[198] separately identify structural breaks in patent litigation filings in 1982. Both studies use the statistical data compiled by the Administrative Office of the U.S. Courts and maintained by the Federal Judicial Center ("FJC"). Merz and Nicholas use monthly time series but employ an erroneous method of determining a structural break[199]. Turner uses a method designed to identify structural breaks with quarterly data. However, upon examining patent litigation statistics in annual terms, the break in 1982 is no more discernable than other breaks and fluctuations in other years. This is seen in Figure 7, showing the annual FJC data as reported by Somaya[200] for lawsuit filing rates of patent, trademark and copyright cases.

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[194] Turner (2005), note 62.

[195] Results of statistical analysis are highly dependent on the models employed. The two contributing factors to Turner's structural break time deviation from the plain trend seen in his own data and from the data of this study are (i) the "spike and depletion" of 1982, which skews the analysis and (ii) the inherent property of the piecewise ***linear segment*** regression model utilized by Turner. It is known to produce biased estimates for the break time T_B of a smoothly inflected time series. In these cases, the resultant estimate appears ***later*** than the true break time. This break time error can be made arbitrarily small by utilizing higher order regression models (by increasing the polynomial order p in Equation 1 given in Vogelsang (1997), cited by Turner). Thus, the unbiased method of using Vogelsang's structural break analysis system requires additional degrees of freedom by sequentially incrementing the order p until no further change in the estimated T_B is observed. Typically, second or third order solutions provide sufficiently stable and accurate estimates. In contrast, Turner's first-order model produces a significant error in cases having smooth growth inflection, as is the case here with patent applications. Turner's limiting himself to temporal mean (zero order) and temporal trend (first order) segments with a single break as the underlying application process 'corrupted' by unrelated 'noise', implicitly presumes an erroneous model of the application process as unnatural and non-differentiable at the break point. This results in breakpoint estimates that are highly dependent on analysis epoch lengths before and after the break.

[196] M.J. Meurer and J. Bessen, The Patent Litigation Explosion, *American Law & Economics Association 15th Annual Meeting*. Working Paper 57. (May 2005), at http://law.bepress.com/alea/15th/art57, (attributing the rapid rise in patent litigation to the establishment of the CAFC, stating at 23 that "barring some explanation we have not considered, legal changes seem to be the dominant factor accounting for the rapid rise in [patent] litigation."); Jaffe & Lerner (2004), note 64, at 13.

[197] J.F. Merz, and M.P. Nicholas, Trends in Patent Litigation: The Apparent Influence of Strengthened Patents Attributable to the Court of Appeals for the Federal Circuit, *Journal of the Patent and Trademark Office Society*, **76,** pp. 579–590, (1994) (presents an analysis of patent application and patent litigation trends and concludes that the CAFC had a contribution to an increase in patent lawsuit filings after 1982)

[198] Turner (2005), note 62, (finding a break in the 3rd quarter of 1982 wherein the average of new lawsuit filings rose to 259 per quarter, an increment of 46 filings per quarter (18%), and the trend slope increased by only 1.6 filings per quarter).

[199] To test the hypothesis that the CAFC has influenced the amount of patent litigation, Merz & Nicholas compare their first linear regression result to a second regression model with an additional degree of freedom introduced by an indicator variable reflecting the creation of the CAFC in April 1982. They conclude that the CAFC had a significant effect because they find that the second model explains significantly greater amount of the variance in the data than does the simple first linear model. Their inference is clearly wrong because ***any*** increase in the number of degrees of freedom in a regression model will ***always*** improve its match to the data set.

The patent litigation data for which Turner finds a break (as seen in his Figure 3) indeed indicates a step in 1982 with a modest relative step size of about 18%. Although the FJC data contains data for 1970 and for many years beyond 1991, Turner neglects to present the larger changes in those years and limits his analysis epoch to 1971-1991. Without providing any explanation for his omission, the (apparently arbitrary) choice of the analysis epoch greatly affects Turner's results. For example, if one includes patent litigation data from 1970 on one end and from 1992 on the other, one finds a structural break that is ***earlier*** than the 3rd quarter of 1982 with a smaller discontinuity in the mean but larger discontinuity in the trend. Similarly, using the years 1975-1985 as the analysis epoch, results in a finding of a very significant structural break in 1980 ***and not*** in 1982. This 1980 break can also be clearly seen in Figure 7. Turner's detection of a relatively minute break in patent litigation trends in 1982, which is far less significant than that in other years, discredits his conclusion. This also in view of the fact that his conclusion takes the small variations in patent litigation time series out of context as pertaining to general civil litigation growth. As seen in Figure 7, in comparison with patent lawsuits, intellectual property suits in trademark and copyright cases experienced more dramatic growth and fluctuations after 1982, even though the CAFC had no jurisdiction on these areas of the law. Moreover, as this figure shows, the rate of patent lawsuit filings over the years has not deviated appreciably in proportion to the number of issued patents. More importantly, patent litigation rates as a fraction of all civil litigation rates has not changed much since 1970: In 1970, 1.17% of all civil lawsuits filed in federal courts were patent lawsuits whereas this percentage was 1.07% in 2005[201]. Thus, the assertion that the CAFC has ushered-in a "patent litigation explosion" or that it had any significant effect on such litigation rates has no basis in fact.

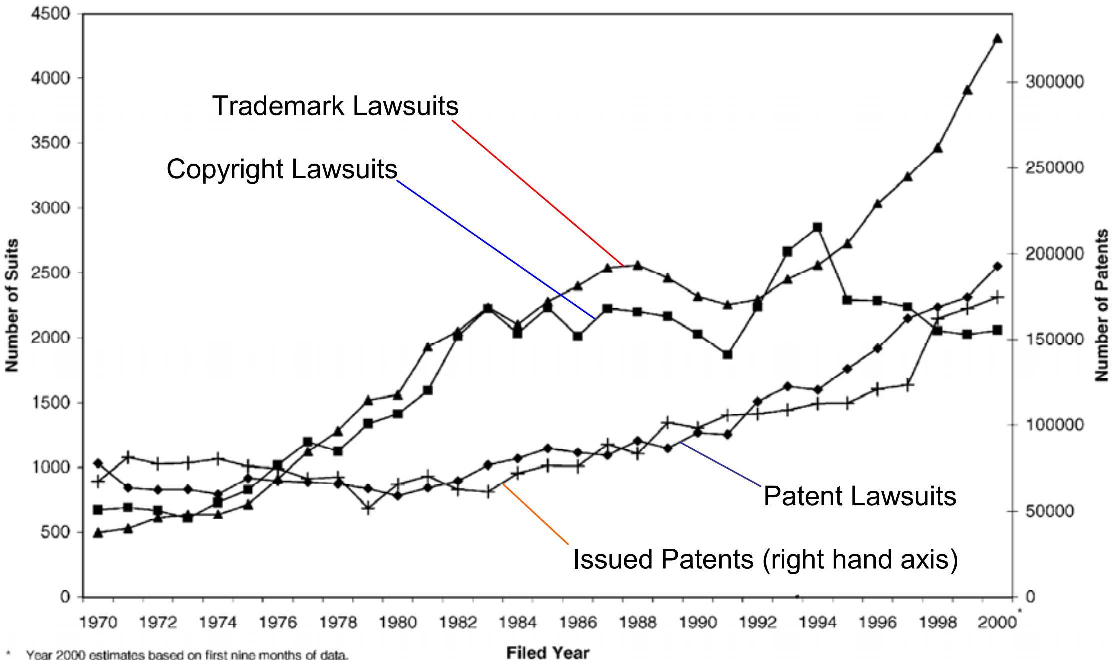

Figure 7. Intellectual property lawsuits filed in U.S. Federal courts by fiscal year. The upward trend in patent lawsuits beginning in 1980 and ending in 1985 with insignificant relative fluctuations compared to those in other years indicates that the establishment of the CAFC in 1982 could not have had any significant effect on patent lawsuit filing propensity. *Source*: Somaya (2004), note 200, Courtesy of Elsevier Ltd.

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200 D. Somaya, Firm Strategies and Trends in Patent Litigation in the United States. In: *Advances in the Study of Entrepreneurship, Innovation and Economic Growth*. (G. Libecap, ed), JAI Press, Greenwich, CT. (2004).

201 Institute for Intellectual Property & Information Law at the University of Houston Law Center, *Patent and all Civil Action 1970-2005*, Patstats project, at http://www.patstats.org/Historical_Filings_PatentSuits_OtherSuits.doc.

Some observers who ascribe the increased patenting trends to the CAFC, argue or imply that other mechanisms attributable to the CAFC beyond the economic and legal factors were at play. They contend that increased patenting were also due to the increased flow of patent applications alleged to have lower quality[202]; and due to the lenient approach to patentable subject mater[203]. All these components, by their nature, must be applicable without much distinction to domestic and foreign applicants alike. However, if the CAFC caused the surge in US patent applications by domestic inventors, why did it not have a statistically significant similar effect on the US application behavior of Japanese, German, British and French inventors? Sam Kortum and Josh Lerner[204] show that patenting in the U.S. during the late 1980's and early 1990's by inventors from the four foreign countries with the most US patents (Japan, Germany, Great Britain and France) did not accelerate significantly from the pre-1982 pattern. In addition, Kortum & Lerner show that US inventors' domestic ***and*** international patenting surged after 1982. Kortum & Lerner also show that the fraction of applications that are successful has not dropped for U.S. inventors, as might be expected if a rising propensity to patent was leading to more marginal patent applications[205]. Based on these findings, Kortum & Lerner conclude that the U.S. grew as a "source" for patents but not as a "target" and thus they reject the Friendly Court Hypothesis[206].

In general, if the CAFC were responsible for most or a substantial part of the increase in U.S. patent applications, one would not expect to observe similarly timed increases in patent applications in foreign countries starting in the 1980s. However, opposite findings of dissimilarity ***should not*** be construed as a proof that the CAFC ***was*** the cause of the increase in the U.S. Nevertheless, studying this question, William Landes and Richard Posner[207], actually find that during that period, Canadian patent application rates were a remarkable proportional replicate of U.S. application rates, exhibiting virtually identical upward inflection in the early 1980's. Separating U.S. and non-U.S. applicants in Canada (their Figure 4), Landes & Posner also rule out the increase in Canadian patent applications as the result of an increase in applications filed by U.S. applicants, who would normally apply in multiple countries[208]. Therefore, one must conclude with reasonable certainty that the U.S. Federal Circuit could not have had ***any significant*** effect on a patent application surge in Canada, having trends ***virtually identical*** to that found in the U.S at the same time. Evidently, one does not need the change in patent doctrines of the CAFC to cause such patent application surges, as the Canadian experience shows. Were factors other than the CAFC (but yet uniquely common to both North American countries at that time) primarily responsible for the similar surges in patent applications? This question had not received a fair treatment thus far.

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[202] Jaffe & Lerner (2004), note 64, (stating at 34: "As a result of legal and administrative changes made between 1982 and 1990, the PTO has become so overtaxed, and its incentives have become so skewed toward granting patents, that the tests for novelty and non-obviousness that are supposed to insure that the patent monopoly is granted only to true inventors have become largely non-operative").

[203] J. R. Thomas, The Patenting of the Liberal Professions, *Boston College Law Review*, **40**, p. 1139, (1999) (arguing at 1163-1164 that Federal Circuit's permissive approach to patentable subject matter has extended patent protection well beyond technology to such things as sports, psychology, law and theology).

[204] Kortum & Lerner, (1998,1999) note 63 above.

[205] Apparently, some patent critics managed to explain away this fact by yet another leap to conclusion that the surge of applications caused the overworked USPTO to have poor examination quality, thereby increasing the grant rate. *See* note 10.

[206] It is rather curious that Professor Josh Lerner appears to have abandoned this conclusion in his excellent scholarly work of the late '90's to change his position and argue without any supporting evidence against his own prior conclusion. In his 2004 book (note 64), after a discussion about the changes made by the CAFC in patent law, he states without proof at 10: "As ***a result***, the rate of patent application filings in the United States began to increase shortly after the creation of the CAFC" (emphasis supplied).

[207] Landes & Posner (2004), note 62.

[208] Multi-jurisdictional patenting practices for domestic and foreign filings often result in their high correlation. In particular, the marginal cost of a patent in a second country is generally lower than it is in the first. For a second (or further) patent, the inventor pays only the filing fees. Hence, there are scale economies and often, the decision of whether to pursue patent protection is implicitly a decision of whether to pursue a US patent with its foreign counterpart or no patents at all. However, Landes and Posner control for such possibility and rule it out as an explanation by observing non-US applicants in Canada.

It is rather remarkable that despite their finding of clear evidence suggesting a patent application surge due to factors ***other than the CAFC*** has taken place, Landes & Posner do not retreat from their original null hypothesis holding the CAFC as the primary cause. Upon the mere additional finding that the Japanese patent application trends at that time had no similar upward inflection pattern in contrast with the U.S. and Canada (Figure 3), Landes & Posner appear to embrace this dissimilarity as 'evidence' that inexplicably negates the inevitable conclusion from their own important findings on Canadian trend similarity. Landes & Posner do not even consider the possibility that the Japanese application trends have had different characteristics than applications in the U.S. (and Canada) for reasons ***other than*** the lack of CAFC jurisdiction in Japan. Consequently, they conclude that the CAFC ***has had*** a significant effect on the U.S. patenting surge "as a consequence of the pro-patent leanings of the new court"[209].

In light of the similarity of the historical patent application trends in the U.S. and Canada, focusing on such similarity, apparently unique to U.S. and Canada, offers a valuable opportunity for more productive research and understanding of the patenting trend. Hence, promising areas of research would be the uniquely common U.S.-Canadian technological factors such as the emergence of the most important technological trend in the last part of the twentieth century. That is the revolutionary emergence of ***microcomputers*** and the ***personal computer*** in the late 70's and early 80's, which at that time was predominantly a North American phenomenon. These new devices critically contributed to productivity gains, cost reductions, acceleration of R&D, acceleration of product development and new product introductions, as well as serving as new platforms for new fields of innovations. The PC also revolutionized abilities of a grater number of people to generate and modify documents including patent applications. The inflection time in the attended revolutionary benefits of microcomputers and PC's substantially coincides[210] with the upward inflection in patent application numbers after 1979 into the early 1980's. Therefore, this hypothesis for explaining the patenting trend must be considered and studied further.

The microcomputers and the personal computer technologies originated in the U.S.[211] with significant spillover ***initially*** only to the economically and technologically tightly coupled neighbor - Canada. In the early 1980's, virtually all PC software applications sold were for English speaking users, dominated by the early North American adoption. During 1982-1985, Canada was second to the U.S. in PC manufacturing market share, while regions having much larger industrial base (Europe and Japan) trailed behind[212]. It is thus possible that this unique North American innovation experience has been a major factor in spurring sustainable patenting growth in other related fields. There is no doubt that the unprecedented wealth created by American microcomputer entrepreneurs in the first part of the 1980's has been a major lightning rod for many more American innovators and inventors. A new standard and scale for much higher possible private wealth creation has emerged in America. More than ever, American innovators sought to emulate such success and were able, more than ever, to tap on American venture capital resources to unleash a period of unique innovation growth[213]. The underlying roots and

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209 Landes & Posner (2004), note 62, at 128.

210 E. Brynjolfsson, The Contribution of Information Technology to Consumer Welfare, *Information Systems Research*, **7**(3), pp. 281-300, (September 1996) (showing in Figure 1 that a major historical break in real purchases of computers occurred in the late 1970's to early 1980's, where only a couple of billion dollar annual market had a first upward inflection in the late 70's that turned into a $50B in 1982, growing even more sharply thereafter to $240B by 1990).

211 R.N. Langlois, External Economies and Economic Progress: The Case of the Microcomputer Industry, *Business History Review*, **66**(1), pp. 1-50. (1992) (discussing the emergence of the microcomputer industry and the personal computer and its explosive growth in the early 1980's, wherein its critical technology elements such as microprocessors, operating system and application software were all U.S. based).

212 J. West, Moderators of the Diffusion of Technological Innovation: Growth of the Japanese PC Industry, *Center for Research on Information Technology and Organizations*, University of California, Irvine, Paper 12, (1996) (showing historical regional market shares at Table 4).

213 S. Kortum and J. Lerner, Assessing the Contribution of Venture Capital to Innovation, *Rand Journal of Economics*, **31**, pp. 674-692, (Winter 2000) (reporting in Table 1 upward inflection trends in VC

onset of this microcomputer revolution started well before, and independently of, the establishment of the CAFC in 1982.

As noted in connection with Figure 4, the fastest growing component of the patenting trend (continuation applications) was remarkably correlated with the growth of new product introductions and trademark applications. There can be no doubt that the patents applied for during the surge in patenting were intended to protect the products introduced and announced at that period. Patents are not applied for products that remain unannounced. Those who maintain that the CAFC was the major cause for the increased patenting trend must therefore explain how the CAFC has had similar effect on the surge in commercial activities as manifested by a surge in trademark applications and new product announcements, neither of which under its jurisdiction. Of course, those who strongly believe in the dominant influence of the CAFC on all matters pertaining to patenting propensity might continue to argue that its legal doctrines actually had an effect on such commercial activity trends through the patenting incentives afforded to applicants. This latter conclusion would therefore imply that the CAFC's patent doctrines had far-reaching impact and is to be credited with the unprecedented innovative and technological growth in North America during the last quarter of a century. In regards to this extraordinary focus on the CAFC, it is worth noting that many of the critics who complain about the CAFC's "pro-patent" stance that causes innovation suppression and that endangers progress, also complain that the patenting surge (and evidently, its technological growth correlates) is due to these same "patent-friendly" leanings of the legal doctrines instituted by the CAFC. These two complaints appear at odds and are reminiscent of the old Woody Allen joke[214] about the food at summer camp: "*The food was awful. And the portions were small too.*"

4.4.3 The Allegations of Patent Continuations Abuse

With provocative slogan-like titles such as "Estopping The Madness At The PTO"[215] and "Ending Abuse Of Patent Continuations"[216], some authors have fervently alleged that the patent continuation process is abused by patent applicants and should therefore be limited or abolished altogether. Of these two articles, the second article by Mark Lemley and Kimberly Moore (hereinafter "L&M") has received wide notoriety and was widely cited by the critics of the U.S. patent system. This article was the only non-governmental reference that the USPTO cited in its recent proposal to limit the continuation practice[217]. However, the paucity of factual data supplied by L&M's to support their contentions of continuations' abuse and the fact that their paper is replete with erroneous conclusions and folklore pronouncements, demands a substantive response. This section provides a critical review of only a few of their assertions because a detailed response is beyond the scope of this paper. It nevertheless shows that the perceived abuses are largely illusory and have no basis in fact.

As a threshold matter, to demonstrate the prevalence of abusive prosecution delays involved with the continuation practice, three matters have to be established. The first is a quantification of the relative number of continuation applications and the extent of the temporal extension of their prosecution pendency. Second, a showing must be made that patent applicants have had control over, or were the major cause for, the very long pendency of such applications. Third, evidence rather than mere allegations must be provided showing that even in cases where applicants have had control over such long pendency, their exercise of such control through filing of continuations was abusive. L&M provide statistical information based on what they claim to be a "comprehensive empirical study of continuation applications, which demonstrates the frequency with which this process is used and ***abused***."[218] (Emphasis supplied). As shown below, L&M's were only able to show statistical data quantifying how

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investments during the late '70's and early '80's that are remarkably timed similarly to computer spending trends and patent application trends).

[214] Professor Robert Merges is credited with introducing this joke to the patent reform context.

[215] *See* Anonymous Note (2003), note 64 above.

[216] Lemley & Moore (2004), note 18 above.

[217] USPTO NPRM (2006), note 13 above.

[218] Lemley & Moore (2004), note 18 above, at 64.

the continuation process is used (addressing the first matter) but fail to provide any relevant information to establish the crucial second and third matters required to show how this process is ***abused***. Evidence related to the second and third matters that in fact contradicts L&M's assertions is discussed below.

L&M actually admit that very long prosecution pendencies are rather infrequent and their study of all patents issued during 1976-2000 shows in Table 1 of their paper that only 1.38% of issued patents have had prosecution pendency exceeding 8 years. They also admit that what they call applicants' abuse is rather scarce[219]. Yet, they suggest that ***every*** application pending eight years or longer ought to automatically be subject to a presumption of abuse[220]. This is remarkable, given that they provide no evidence that even comes close to showing that this small fraction of very long pendency applications has such very long pendency due to applicants' control, let alone abuse. L&M's lengthy discussions of the presumed motivation of applicants to engage in protracted continuation prosecution lacks any factual basis and fails to rule out any other factors that might lead to very long pendencies of the small fraction of pending applications. They only mention in passing other possible causes for very long pendencies but make no attempt to rule them out as major contributors. While L&M only make anecdotal mention of government secrecy orders that can hold up patent applications for many years due to national security reasons, they fail to mention their incidence rate in the total application pool. It is shown here that such applications were actually dominating the pool of applications with very long pendencies.

Patent applications subject to secrecy orders[221] are assigned to a separate examination group and the USPTO will not issue a patent or permit an abandonment of an application while it is subject to a secrecy order. Thus, such applications technically remain pending until the secrecy order is lifted. In that regard, most instructive would be the examination of data from a time just prior to the 1995 law change, when applicant continuation "abuse" alleged by L&M would have been at a high point by their logic. From a GAO report to Congress[222], one learns that as of October 1, 1994, the USPTO had 294,565 patent applications in process, which had an average pendency of 25 months if one considers the original parent application date. One also learns from that report that ***3,653*** (1.24%) applications in process at that time were, or at one time had been, subject to secrecy orders. The pendency of these secrecy order applications in process averaged 86.2 months (7.2 years) with a maximum of 189.3 months (15.8 years). This implies that a major part of the age probability mass for these secrecy order applications concentrated well beyond 4 years of pendency. This GAO report also states that of the 294,565 applications in process as of that time, only 2.7% (7,953) had pendency exceeding 4 years, of which 82% (6193) were said to have experienced such delays beyond PTO's control. Therefore, it is concluded that ***6193*** applications in process as of that time experienced delays beyond 4 years either due to applicants' control or due to secrecy order delays. Generally, the number of applications older than 4 years declines rapidly with age. In contrast, because of the significantly older nature of the 3,653 secrecy orders applications, their numbers were likely skewed more towards their average pendency of 7.2 years and therefore one can reasonably conclude that secrecy order applications were the major portion of applications in process that were substantially older than 4 years. It is therefore reasonable to conclude for example, that if one were to examine the cause for delay of all applications in process older than 8 years, one would have found that most of those applications were members of the secrecy orders group of

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[219] Lemley & Moore (2004), note 18 above, at 94, ("There are only a few inventors who are severely abusing continuation practice. Those abuses are spotlighted because the inventors who abuse the system are more likely to litigate their patents. The abuse, while severe, is narrow in scope. As Table 1 demonstrates, only a few patents issued with particularly lengthy prosecutions based upon numerous continuations.").

[220] Lemley & Moore (2004), note 18 above, at 113, ("We suggest that any patent pending eight years or longer ought to automatically be subject to scrutiny for laches — a presumption of laches.").

[221] Under 35 U.S.C. § 181, patent applications for inventions that could affect national security interests can be placed under a secrecy order by the USPTO if the applicable federal agency determines that such protection is necessary. The USPTO withholds the publication of the application or the grant of a patent for such period as the national interest requires.

[222] United States General Accounting Office, *Enhancements Needed in Computing and Reporting Patent Examination Statistics*, GAO/RCED-96-190, (July 1996), at http://www.gao.gov/archive/1996/rc96190.pdf (See pages 5-8).

3,653 applications. Evidently, secrecy order delays were likely the major cause for ***very long*** pendencies of applications in process at the USPTO as of October 1, 1994, and not applicants' delay, let alone applicants' abusive delay.

The conclusions for FY 1994 in the foregoing paragraph are significant. Because, if at that time, applications with pendency delayed by their applicants were only a minor fraction of the very long pendency application population, then this fraction must have been even smaller in years after 1995, when applicants' alleged incentives to delay must have declined. While the information above does not permit an assessment of the exact mix of long pendency applications, it is sufficient to demonstrate that L&M's rush to conclusions and their attribution and presumption of prevalent applicants' control as the cause of the longest prosecution delays has no basis in fact. Therefore, L&M not only fail to establish the second matter mentioned above, but evidence to the contrary appears to suggest otherwise.

As to the third matter of actually demonstrating abuse, a showing must be made that applicants with applications subject to very long pendencies actually intended to benefit from a long ***secrecy*** period. Here, L&M fail to establish that very simple fact related to applicants use of continuation applications. At page 79 they state:

> "Intentional delay to increase the value of the resulting patent is referred to as "submarine patenting" because the patents surface ***unexpectedly*** and take competitors by ***surprise***." (Emphasis supplied)

Clearly, the secrecy of an application that is subjected to long prosecution pendency is a prerequisite for it to be considered as a possible abusive "submarine". L&M sweepingly presume without proof that all continuation applications they analyzed were secret until granted. However, this is far from being true. All continuation applications descend from a parent application having identical specification and disclosure and if such a parent or a related foreign application is issued or published earlier, the content of the pending continuation application is available to the public during the delay period. So in collecting statistics on the non-original applications including their respective parent application date from which L&M construct their Table 1, they failed to exclude all applications that applicants did not keep secret due to the earlier issuance or publication of a related application. Since L&M traced all parent applications to determine the priority filing dates they used for their Table 1, they could have found which parent application or related foreign application was previously granted or published. This inquiry and determination of the fraction of continuations that were actually secret ***should have been central to their contention of abuse***. If such backtracking analysis of related published applications appears difficult to perform across the ensemble of all non-original applications, L&M could have drawn a small sample for manual analysis on a case-by-case basis in order to assess the plausibility of their prevalent "submarine" hypothesis. They have done no such thing.

A cursory manual check of prior parent publication of patents issued from non-original applications was performed by this author for patents issued after prosecution pendency longer than 10 years. In order to examine an application period during which incentives for "submarines" might have been at a high point according to L&M's logic, application dates during the year just before the 1995 change of patent term came into effect were selected. As L&M did not distinguish between continuations, CIPs and Division in their statistical analysis, so did the selection of the non-original applications of this brief study. The first 10 such patents on the resultant hit list[223] were then inspected and their related applications and foreign family counterparts were identified[224]. It was found that 8 out of these 10 latest non-original application patents had parents or foreign family counterparts that were previously published. Four of these 8

[223] The advanced patent search mode at the USPTO web site was used for patents granted as of May-29-2006 with application dates within a year prior to the patent term change effective date, using the following query: "APT/1 AND APD/jun-08-1994->jun-08-1995 AND (PARN/application OR PARN/No OR PARN/filed OR PARN/filing OR PARN/divison$ OR PARN/continuation OR PARN/CIP)". 59689 hits were found and the first ten patents on the hit list had grant dates between Apr-18-06 and May-23-06.

[224] The European Patent Office database at http://ep.espacenet.com was used for foreign family or priority identification.

previously published patents had foreign or PCT counterparts claiming the priority of the family parent[225]. Thus, ***only two out of ten*** patents could qualify as having had a secret long pendency prosecution.

Beyond the cursory information reported above for application periods prior to 1995, there is other definitive evidence that the practice of continuations is not motivated by secrecy considerations and that applicants generally do not elect to prosecute their applications in secret. A National Research Council report by the Committee on Intellectual Property Rights in the Knowledge-Based Economy, indicates that since patent application publication rules have been adopted in 1999, only one in ten applicants elect under 35 U.S.C. §122(b)(2)(B) not to publish their patent applications[226]. Because almost all applicants since 1999 do not use secrecy, had the secrecy motivation been a major cause for filing continuations before 1999, such publication requirement would have squelched the robust continuation growth trend. Accordingly, attenuation of growth should have been observed after 1999. However, as Figure 1 shows, nothing of this sort occurred and no appreciable change in the growth slope of continuations since then can be observed. Evidently, the underlying factors driving continuation patenting growth have very little to do with secrecy or submarine motives.

The foregoing analysis suggests that there is a major deficiency in L&M's abuse theory. Secrecy of pending applications at the USPTO is their central premise. Clearly, their continuation abuse theory simply implodes if one finds that even before U.S. publication rules were enacted, most applicants who had long pendency continuations did not prosecute ***long "submarines",*** as L&M contend, but rather prosecuted ***"tall ships" with 'sails full and by'*** for all to see. In assessing even the minority of applications that were subject to longer prosecution delays due to applicants' control, even a much smaller fraction of those were apparently prosecuted in secret. Therefore, L&M fail to demonstrate that such applicants' controlled delays were pervasive or abusive and not simply due to the legitimate reasons elaborated in Section 1 and Section 4.2.2 above. L&M do not only fail to consider actual relevant facts in their paper, but they also adopt bizarre myths regarding the patent prosecution practice, as discussed below.

The "Worn-Down Examiner" Myth. In the introduction to their paper on page 65, L& M introduce this most pervasive myth that has been propagated, quoted and misused by other critics of the U.S. patent system:

> "[T]he structure of the PTO suggests that continuations may well succeed in "***wearing down***" the examiner, so that the applicant obtains a broad patent ***not because he deserves one***, but because the examiner has neither incentive nor ***will to hold out any longer***." (Emphasis supplied).

On page 68, L&M state that

> "If none of this works, the applicant can file yet another continuation application, ***and so on ad infinitum***. There is no way an examiner can ever cause a determined applicant to go away, although ***allowing*** the applicant's patent claims ***increases*** the chance that the case will finally be disposed of." (Emphasis supplied).

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[225] Lemley & Moore (2004), note 18 above, at 89, noting that none of the fifty patents with the longest delays they analyzed claim priority to any foreign filings. But they have not checked whether foreign filings may have been made for these patents after the U.S. patent filing, claiming the U.S. priority. It should also be noted that according to their Table 1, these fifty patents with the longest delay were filed at least 36 years prior to their grant. This means that these fifty patents' latest filing date could not have been later than 1964 – a time prior to which very little foreign patenting took place in the US.

[226] S.A. Merrill, R.C. Levin and M.B. Myers, Eds, *A Patent System for the 21st Century*. National Academy of Sciences, (2004). Available at http://fermat.nap.edu/html/patentsystem/0309089107.pdf . (Table 3-1 at 65 citing USPTO data for FY 2001 and FY2002 indicating that of all applications only 9.9% and 11.1% respectively opted for non-publication).

Here, L&M suggest that examiners are somehow better off by allowing and not rejecting "stubborn" continuation filings of dubious claims. They contend that a patent examiner can only finally dispose of an application by allowing it[227]. This myth is based upon a combination of misinformation and a misunderstanding of the examiner award system. For any award to be received, the examiner's work must be satisfactory in quality[228]. In addition, contrary to the myth, individual examiner productivity is measured in terms of "counts" that are ***not*** biased towards claim allowance. Examiners receive one count for each first office action and one for each disposal, which together equals one production unit[229]. Examiners receive count credit even when they finally reject and dispose of an application ***without*** any claim allowance. Contrary to L&M's assertions, if anything, examiners actually have more incentives to reject "dubious" applications than to allow them. This is because refiled continuation applications (such as RCEs) provide examiners, who are by then familiar with the application and the related prior art, with examination activity that requires much less work. This provides examiners with "free" counts that help improve their production quota. Moreover, upon rejection of a prior application, applicants can't just recycle the same claims in a new continuation because failure to raise a new issue in a continuation application vis-à-vis the issues raised in the prior application will result in a first action final rejection by the examiner[230]. Such final rejection accelerates the disposition, for which the examiner receives "free" credit. Therefore, no examiner can benefit from allowing an application rather then rejecting it in order to receive a disposition credit. The exchange between the applicant and the examiner over the scope of the claims and the prior art converges after a series of amendments to allowance, or to final rejection. Such convergence is by no means based on "attrition" under which the examiner is "worn down" and somehow pushes through an application that is otherwise not worthy of a patent grant. There is simply no incentive structure for examiners to yield that way. On page 75, L&M further state:

> "Alternatively, if an applicant is faced with a determined examiner, continuation practice may allow the applicant to "wait out" the examiner and hope that the new application will be assigned to a different examiner, perhaps because the original one has quit. "Examiner-shopping" is ***a common practice***, but the Federal Circuit has recently taken some steps to limit ***its abuse***." (Emphasis supplied).

In the foregoing, these authors only cite one such case, one decided by the CAFC as involving inequitable conduct. They provide no evidence as to the degree or frequency of use of such "wait out the examiner" practice by applicants. Nor do they show in any way that such practice is ***common***, as they claim. On that same page they make this most remarkable statement:

> "If continuation applications permit the applicant to wear down the examiner — obtaining a patent that the PTO would ***otherwise refuse to grant*** — they give applicants with dubious claims to ownership intellectual property rights that they can enforce against the world. It is inevitable that the PTO will make mistakes. But continuation applications may be more likely than average to result in ***bad*** patents. This is particularly troublesome for society because our empirical evidence suggests that patents based on continuation applications are far more likely to be litigated than other sorts of patents." (Emphasis supplied).

In this remarkable pronouncement, L&M again exhibit their lack of patent prosecution experience suggesting that the continuation practice results in ***bad*** patents that ***would otherwise not issue***. They do not define what ***bad*** patents are but apparently by that they mean, patents that issue after having the most extensive prosecution records and amendments, typical of patents issued from continuations. They provide no evidence of any kind that supports their contention. Their logic is breathtaking in its distance from reality and it defies ***even their own*** empirical research and conclusions to the contrary. In their well-known paper on *Valuable Patents* published in the same year, L&M and their co-authors convincingly show based on facts that patents issued from continuations are actually ***the most valuable*** patents[231]. As discussed earlier, the facts also show that patents issued from continuations are the ***most sustainable*** under validity challenges in patent litigation[232], which hardly qualifies them as ***bad*** patents that were just "pushed through" by a "worn-down" patent examiner. Apparently, what L&M call a "bad" patent is a valid patent that is only bad for those who infringe on it. The worrisome aspect of these incredible assertions by L&M is that despite evidence to the contrary, they appear to be widely cited and repeated.

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[227] Lemley & Moore (2004), note 18, at 64.

[228] See discussions on patent examination quality in: Doody (2006), note 10, at 14-15; L.B. Ebert, Text relevant to the examination quality argument. Excerpt available at http://ipbiz.blogspot.com/2007/01/lafrance-on-jaffelerner-on-patent.html. From the WSPLA/OPLA meeting, (April 22, 2005).

[229] For a description of the current USPTO examiner assessment and incentive system see: U.S. Department of Commerce, Inspector General, *USPTO Should Reassess How Examiner Goals, Performance Appraisal Plans, and. The Award System Stimulate and Reward Examiner Production*. Final Inspection Report No. IPE-15722, (September 2004).

[230] *See* MPEP §706.07(b).

The Undue Monopoly Expansion Folklore. At page 78 L&M articulate what appears to be an imported policy concept that appears political rather than legal:

> "Permitting patentees to change claims to track competitor's products invites abuse of the system. This practice seems fundamentally ***unfair***, since a competitor who was legitimately ***the first to invent*** a particular device or process may be held to have infringed on a patent claim ***written after*** (and indeed because of) ***that invention***". (Emphasis supplied)

This position is based on a fundamentally flawed logic and a mischaracterization of the priorities and equities related to patentee and competitor's patent rights. First, it should be clear that competitor's ***inventions*** couldn't be accused of infringing on patent claims. Rather, it is the competitor's ***products, devices or processes*** that may infringe on the patentee's claim. Second, by definition, the competitor could ***not*** have been ***the first to invent*** the subject matter of the patentee's claim. While the patentee's claim may have been written subsequent to the competitor's ***product*** introduction, the patentee's ***invention*** and its disclosure were not. Otherwise, the competitor's accused product can be used as prior art in an invalidity defense. Third, the competitor's accused ***product*** may, or may not, exploit new inventive elements and if it does, the competitor's invention must necessarily be **distinct** from that of the patentee. For example, if the patentee invented a new car having five wheels but did not claim its *five-wheel* features initially and the competitor invented a *stabilized pentagon structure* that can be advantageously used for *five-wheel cars*, the patentee should not (and does not) have a right to bar the competitor from making *stabilized pentagon structures*. Nor can the competitor be barred from making cars that employ his patented structures for any purpose ***if*** these cars are not *five-wheel cars*. Conversely, the patentee can make *five-wheel cars*, or for that matter, other types of cars, ***provided*** they are not incorporating the *stabilized pentagon structure* as patented by the competitor. Thus, each inventor retains exclusive rights to their own invention and has a right to bar its exploitation by others.

What L&M appear to suggest, is that it would be fundamentally unfair to bar the competitor from freely making *five-wheel cars* because the competitor has a useful and ***newer*** invention for a *stabilized pentagon structure* that can singularly and dramatically improve *five-wheel cars* more than ever. L&M imply that inventive improvements over prior inventions must be accorded protection priority at the expense of inventor rights of the prior inventions for which the patent term has not yet run out. This is the typical cumulative invention and innovation suppression argument[233], which was examined and effectively refuted elsewhere[234]. Nevertheless, L&M contend that it would be only "fair" to allow the competitor to misappropriate and practice the patentee's prior invention of a *five-wheel car* in order to achieve the public interest goals of making available the special beneficial new combination of *stabilized pentagon structured five-wheel cars*. Of course, L&M do not suggest the symmetrically opposite proposition - that the *five-wheel car* patentee should instead be permitted to freely exploit the competitor's later invention of the *stabilized pentagon structure*, so that the patentee, and not the competitor, may be the one imparting to the public the great benefits of *stabilized pentagon structured five-wheel cars*. Armed only with the lack of prior public notice argument, L&M do not offer any solution other than that of denying the patentee the right to his prior invention if not initially claimed in his original patent application. In contrast, market solutions through coordination and cross licensing have already shown to be far more equitable by respecting the patent rights of both parties. Business frameworks for such coordination have also been proposed[235].

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[231] Allison, Lemley, Moore & Trunkey, (2004), note 74, at 463, ("Our studies provide resounding support for the factual predicates of the patent value theory by demonstrating that patents with the most extensive prosecution records are also the most valuable patents.").

[232] See note 75.

[233] Two papers stand out for grounding their claims of patentee suppression of innovation in the historical record: R. Dunford, The Suppression of Technology as a Strategy for Controlling Resource Dependence, *Administrative Science Quarterly*, **32**, pp. 512-525 (1987); and Merges & Nelson (1990), note 65 above. However, see Howells (2005), note 234.

[234] *See, e.g.*, J. Howells, Are Patents Used To Suppress Useful Technology? A Critical Review Of Allegations Of Technology Suppression Involving Patent Monopoly And Broad Scope In Management, Law And Economics. *Working Papers from Aarhus School of Business,* No. 2005-10, (2005). At: http://www.hha.dk/man/cmsdocs/WP/2005/2005-10.pdf (Showing that the historical evidence cited by Dunford,

In this general context, L&M state on page 107:

> "One of the most ***egregious abuses*** of continuation applications described above is the use of the process to change patent claims to track inventions first made by one of the applicant's competitors. Central to this abuse is the applicant's ***ability*** not only to change claims during prosecution, but also to broaden those claims to cover inventions that may or ***may not be supported*** in the initial disclosure but are not within the scope of the ***claims as initially filed***." (Emphasis supplied)

As a first response, contrary to their legally uninformed statement above, and as patent law professors Lemley and Moore must know well from 35 U.S.C. §112, patent applicants have ***no ability*** at any time to broaden claims that are ***not supported*** by their initial disclosure. Furthermore the ***claims as initially filed*** are irrelevant and cannot limit the scope of any other claims. The written description requirements of 35 U.S.C. §112 provide that one looks in the ***disclosure*** for claim support and not in other claims filed initially[236]. Fortunately, L&M's paper is self-contained with its own rebuttal to this statement and on page 91, L&M thoroughly refute their own importation of this "fairness" folklore and provide extensive authorities that clearly articulate the §112 requirements in their footnotes 115 and 116. Second, a patentee practice that L&M call an ***egregious abuse*** of the continuation process by "late claiming", is in fact a legitimate intellectual property protection practice as conferred by Congress under 35 U.S.C. §120, §121 or §132(b) and repeatedly sanctioned by the courts[237]. Here again, L&M's paper is self-contained

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Merges & Nelson has been misinterpreted as providing evidence of technology suppression. "What it really reveals are a variety of practical problems in the administration of the patents system as a system of development prospects."). A revised version of this paper is included in these proceedings: J. Howells, Patents and Downstream Innovation Suppression – Facts or Fiction?, *Southern California Law Associations Intellectual Property Spring Seminar*, June 8–10, 2007, Laguna Niguel, CA.

[235] *See, e.g.*, F.S. Kieff, Coordination, Property & Intellectual Property: An Unconventional Approach to Anticompetitive Effects & Downstream Access, *Emery Law Journal*, **56**, pp. 327-438, (2006) (shows how stronger, or property rule, enforcement facilitates the good type of coordination that increases competition and access. Further shows how, paradoxically, the reforms urged by patent system critics end up facilitating the different, bad type of coordination that decreases competition and access); F.S. Kieff and T.A. Paredes, Engineering a Deal: Toward a Private Ordering Solution to the Anticommons Problem, *Stanford Law and Economics Olin Working Papers*, No. 330, (November 2006). Available at SSRN: http://ssrn.com/abstract=948468 (Describes an approach structured so that IP owners are given an actual stake in an operating business of an IP enterprise and thus an incentive to participate in the enterprise; and yet at the same time, the IP owners face a number of constraints that mitigate their interest in acting opportunistically by holding out. Through careful attention to IP owner payoffs and self-restraint, the proposed structure is designed to coordinate behavior among relevant IP owners, thus overcoming the anticommons problem).

[236] *See, e.g., Westphal v. Fawzi*, 666 F.2d 575, 577-8, C.C.P.A, (Dec 10, 1981) (rejecting the theory, known as "late claiming," holding that claims presented later during prosecution having §112 support in the specification, and that are entitled to the benefit of an earlier filing date, could nonetheless be barred by intervening rights under §102(b). "Though introduction of new matter into the disclosure falls under the prohibition of 35 U.S.C. §132, later submitted claims need only be reviewed for support in the original disclosure.")

[237] See note 19 above.

with its own rebuttal of the alleged abuse and at page 77 they cite *Kingsdown*, a case among the many listed in footnote 19 above, refuting their assertions about this continuation claim amendment practice.

One must therefore question what considerations prompted L&M to write their paper and to allege abuse of the continuation practice. L&M's theory is predicated on the propositions that such practice is used for ***wearing down the examiner***, ***surprising the industry***, or ***extending one's monopoly***[238]. As this section shows, L&M's paper is full of misstatements and contradictions proving none of these contentions. Merely stating them does not make them true. Observing that there are many continuations, or that patents from continuation applications are more likely to be litigated, does not demonstrate that the continuing application process is being abused, flawed or in need of revision. While superficially appealing to the U.S. patent system critics, L&M's continuation abuse arguments are simply inconsistent with the facts.

4.4.4 The Secrecy Theory of Continuation Patenting

In a series of recent publications[239], Stuart Graham and David Mowery (hereinafter "G&M") have proposed a theory of patenting trends holding that a major driver of continuation patenting is the patentee's secrecy motives. They suggest that firms with a first-mover advantage, or dominant position, may have incentives to use the patent continuation procedure to prevent competitors from discovering competing technologies. They also hypothesize that technology first-movers may have an incentive to prevent follow-on innovation, and the continuation provides the institutional mechanism for incumbent technology firms to act strategically in the veil of secrecy while not losing the future potential of appropriating their inventions in patents. They argue and provide evidence, which they believe proves that the continuation application affords the patentee a strategic opportunity, to secure a more valuable secrecy than simple trade secret allows.

This hypothesis that secrecy is the key driver of firms' use of patent continuations appears seductively plausible as a general rule but G&M cite only a couple of anecdotal cases to support their contention. Contrary to G&M contentions, it is largely inconsistent with the broader facts showing that secrecy is at most a very minor factor in continuation patenting. G&M's theory is predicated on a major payoff of an added period of non-disclosure that the patentee captures by filing continuation applications[240]. As such, the major deficiency of G&M work is that it failed to establish that the set of continuation applications they studied were in fact secret. Like Lemley and Moore, G&M simply ***assumed*** that all continuation applications were not disclosed until they were granted. They identified and equated every pending continuation application as a secret pending application. That is simply wrong. All continuation applications descend from a parent application having identical specification and disclosure and if such a parent or a related foreign application is issued or published earlier, the content of the pending continuation application is in the public domain. Clearly, such continuation applications are not secret. So in collecting statistics on the continuation applications including their respective parent application date from which they construct pendency, G&M failed to exclude all applications that applicants did not keep secret due to the earlier issuance or publication of a related application. In tracing all parent applications to determine the priority filing dates, G&M could have found which parent application or related foreign application was previously granted or published. There is no such control in their study. This inquiry and determination of the fraction of continuations that were ***actually*** secret ***should have been***

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[238] Lemley & Moore (2004), note 18 above, at 92.

[239] S. J. H. Graham, *Continuation, Complementarity, and Capturing Value: Three Studies Exploring Firms' Complementary Uses of Appropriability Mechanisms in Technological Innovation*. Ph.D. dissertation, University of California, Berkeley. (2004). Chapter 2 entitled '*Patenting in the shadow of secrecy: Innovators' uses of U.S. Patent Office continuation practice, 1975–2002*' and Chapter 3 entitled '*Hiding in the patent's shadow: Firms' uses of secrecy to capture value from new discoveries*' are each available in slightly updated and revised form at http://tiger.gatech.edu/files/gt_tiger_patent.pdf and at http://tiger.gatech.edu/files/gt_tiger_hiding.pdf respectively; Graham & Mowery, (2004, 2005), in note 113 above.

[240] Graham dissertation (2004), note 239, at Ch. 3.3.

central to their contention of secrecy. If such backtracking analysis of related published applications appears difficult to perform across the ensemble of all continuation applications, they could have drawn a small sample for manual analysis on a case-by-case basis in order to assess the plausibility of their prevalent continuation secrecy hypothesis. As previously discussed, only a small fraction of continuation applications are prosecuted in secret[241].

G&M's treatment of all continuation applications as secret applications emanates from what appears to be their systemic confusion between the two as evident from their statement about the 1999 patent application publication requirements:

> "… data analysis cited in Graham (2004) shows that approximately 20 percent of patents granted in each of the years 2000 through 2002 were issued with continuation application lineages. Another estimate, by Attridge and Corbett (2004), puts ***this share*** at closer to 10 percent, but the share remains a significant portion of patent applications.[242] (Emphasis supplied).

In fact, the 10 percent share that Attridge and Corbett[243] clearly referred to is ***not*** the share of continuations but rather the share of applications that are kept secret under 35 U.S.C. §122(b)(2)(B)[244]. Attridge and Corbett did not discuss patent continuations or equate their share to the share of secret applications. But G&M apparently think that secret applications and continuation applications are the same thing.

That said, based on the data discussed above, secrecy motives might well have been a cause for use of continuations by a ***very small minority*** of continuation applicants. In his Ph.D. dissertation, Graham actually provides information that permits the numerical estimation of how small a role the secrecy motive plays in continuation patenting. He cleverly uses industry survey that measured industry sector's perceived value of secrecy, establishing a secrecy value indicator and correlating such secrecy indicator with the likelihood of use of continuations. Based on his finding, one can conclude that a change in the perceived value of the secrecy indicator by one standard deviation indicates that a firm in that industry is likely to increase its share of continuations by only 3%[245]. Although secrecy is a minor contributor, G&M missed an opportunity to correctly test which industry segments use continuation practice for actual secrecy reasons because they failed to relate the few continuation applications that were ***actually*** secret with the industry sectors that used them.

It is remarkable that despite Graham's own finding that secrecy is numerically a ***minor*** determinant of the likelihood of firms' use of continuations, he does not attempt to discover what in fact ***is*** the ***numerically major*** factor that determines the likelihood of firms' use of continuations. Finding that secrecy is a ***statistically significant*** factor does not mean that it is consequential or that it is ***a major driver***. If secrecy motives may explain only 3% of the continuation share (albeit with high statistical reliability), what explains the other 20%? Nowhere in G&M's work is an attempt to sample actual claims and prosecution history of original patent applications and their continuations to learn about examples of ***real reasons*** for the continuation practice. Nowhere in G&M's work was there an attempt to prove the secrecy motive by showing that patentees lingered in prosecution longer than required to obtain claims they believed they were entitled to and that they actually did so in secrecy. If secrecy was a major driver, incidences of abandonment of applications with allowed claims in favor of a continuation that recaptures these claims for further delay should have been frequent and easy to document. Instead, in order to rule out alternatives, Graham looks at what he believes to be the only alternative explanations for the continuation practice other than secrecy[246]. A leading alternative he considers is the "*wearing down the examiner*" hypothesis that appears to be a favorite among certain authors unfamiliar with actual patent prosecution practices (see Section 4.4.3). Like Lemley and Moore, Graham regards this mythical attrition practice as generating bad patents, or what he calls "***junk patents***" of lower value. A second alternative he considers is technology complexity, which might necessitate elaborate exchanges with patent examiners, thereby increasing the likelihood of continuation patenting.

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[241] See the discussion on page 53 and related footnotes 223 and 226.

[242] Graham & Mowery (2005), note 113 above at 136.

[243] D. Attridge, and G. Corbett "Patent and Antitrust, Happy Together?" *Legal Times*, Supplement, March 15, (2004), at Section 7.

[244] See information on the share of secret applications at note 226 above.

[245] Graham dissertation (2004), note 239, (Table 3.3 and accompanying text. Among other variables, Graham's analysis compares the secrecy indicator with the frequency of patent continuation use. Graham's regression analysis finds that a change in the value of the SECRET coefficient by one standard deviation indicates that, ***within his controlled sample*** a firm in that industry is 7% more likely to engage in continuation patenting. His 7% likelihood increment overestimates the share change because it does not take into account the fact that continuations had a share of 50% in ***his*** controlled sample, some 2.5 times higher than their actual share. Appropriate conditional probability scaling (which Graham failed to apply) results in an effect of less than 3% in actual continuation share due to the SECRET indicator.

In considering these alternatives, Graham considers the lack of forward citations that patents receive as a proxy for "junk" patents. His logic is similar to that of all those who use forward citation for valuing patents. He argues that his findings show that "*the "junkiest" patents – those patents receiving zero citations as prior art in five years from issue date – are approximately 21% more likely to have been continued than the baseline (mean cited) patent in the same broad technology class*"[247]. His reliance on forward citation to assess the value of ***continuation*** patents shows the lack of understanding of the patent citation system as used by examiners. As explained in Section 4.1, ***continuation*** patents are seldom cited as prior art because their ***parent*** applications contain identical disclosure that issued and published earlier and are therefore better earlier prior art on which examiners rely. Graham's conclusion based on low forward citations that these are "junk" patents having less valuable property rights cannot be further from reality[248]. Graham actually admits himself that his (erroneous) conclusion is "puzzeling":

> "While these results may reflect the importance of gaining a "quick" patent on a valuable technological improvement, the result is nevertheless puzzling. Although decision makers in firms are presumably in the best position to judge the value of the patent, they appear to be incurring additional costs through continuation to earn patents on arguably less-valuable property rights."[249]

As explained above, based on his low forward citation results for continuations, Graham would only be justified in concluding the opposite from his thesis' conclusion. It is that these continuation applications ***were not secret***, as their parents were published earlier, drawing away any pertinent citations from these continuation descendants.

While Graham claims to have found some support for his alternative explanations for the continuation patenting trends, he concludes without numerical proof that the secrecy hypothesis best explains the variability in his data. Additional evidence that G&M point to in support of their hypothesis that secrecy is the key driver for continuation patenting is the post 1996 decline in the share of continuations in U.S. patents they analyzed. They suggest that the 1995 legislation reversed growth in U.S. continuation patenting, an observation they attribute to the attenuation of patentees' prosecution delay incentives[250].

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[246] Graham dissertation (2004), note 239, at Ch. 3.5 '*Conclusion*', ("Because I contended that a key driver of continuation patenting is the firm's secrecy motives, I test various alternative explanations for firms' use of the procedure").

[247] Graham dissertation (2004), note 239, at Ch. 3.4.3.

[248] As explained in Section 4.1, the facts show that continuation patents are often the most valuable and most sustainable under validity challenges in patent litigation. See footnotes 73, 74 and 75 and their related text.

[249] Graham dissertation (2004), note 239, Ch. 3.4.3, at 115.

[250] Graham & Mowery (2004), note 113, at 450, ("The post-1996 decline in the share of continuations in US software and non-software patents suggests that the 1995 legislation reversed growth in US continuation patenting, although the share of continuations has declined only to levels comparable to those observed in the mid-1980s".); Graham & Mowery (2005), note 113, at 143, ("The downward trend in the share of non-software continuations after 1997 may reflect the fact that patents issuing during and after this year are the first to reveal the effects of the 1995 changes in U.S. patent law."); Graham dissertation (2004), note 239, Ch. 2.4.1, (explaining Figure 2.4: "The downward trend after 1997 may be an indication that the disincentives intended in the 1995 Act have had an impact

They do note, though, a substantial increase in the share of continuations prior to the sharp declines after 1997.

As Figure 1 shows, G&M were wrong in concluding that patent continuation applications have declined after 1997. There are two likely causes for their mistaken observations and conclusions. First, they have examined issued patents and not application statistics. And as Graham shows[251], patents granted from continuations take longer to issue and G&M's use of statistics for patents granted in the later years missed many continuation patents that were filed during later years but did not issue because of their longer pendency. This led to a bias towards an apparent reduction of continuation share in granted patents. The second and more important reason for an additional observed reduction in continuations share in granted patents after 1997 is the ***temporary*** depletion of non-original applications discussed in Section 3.2.1 ("Spike & Depletion"), resulting in significant reductions in the continuation share in later years. This reduced share was mistakenly attributed by G&M to applicants' change of behavior in response to the 1995 Act, ostensibly due to the new limitation on applicants' ability to extend their patent term by filing continuations. While the cause for a transient continuation share reduction was due to the 1995 Act, evidently it was temporary and was not due to the reasons that G&M proposed.

Returning to G&M's secrecy hypothesis, it is evident that the 1999 Act requiring the publication of applications has had no measurable change in the motivation or propensity to file continuations. Had the secrecy motivation been a key driver for filing continuations before 1999, such publication requirement would have squelched the continuation applications growth trend. Accordingly, lower growth would have been observed after 1999. However, as Figure 1 shows, no appreciable change in the growth slope of continuations after 1999 can be observed. Evidently, the underlying factors driving continuation patenting growth have very little to do with secrecy motives.

By positing applicants' secrecy motives in filing continuation applications, G&M neglect to consider or even mention some of applicants' ***disincentives*** for maintaining patent applications in secret. Applicants' advantages for publishing their applications are based on several factors. The first is the provisional rights under 35 U.S.C. §154(d) awarding patentees a reasonable royalty for infringement that occurs after publication but ***before*** patent issuance (see note 32). Second, firms have an incentive to disclose their inventions early even if they intend to pursue patent protection later. The reason is that such disclosure increases the patenting bar for rivals and by making it more difficult to patent, disclosure extends the patent race. If an invention of a certain quality would have been sufficient to qualify for patent protection before the disclosure, any invention after the disclosure must be that much better before it will represent a sufficient non-obvious advance over the now-expanded prior art.[252] Other reasons for disclosing patent applications involve strategic signaling to others[253], or when such publicity helps firms recruit employees and attract investment capital. In conclusion, applicants routinely engage in balancing these and other advantages with those of maintaining secrecy, and as mentioned above, in the overwhelming majority of the cases, they opt for publicity. G&M have failed to provide evidence to their express assertion that a "key driver of continuation patenting is the firm's secrecy motives" because they erroneously attributed secrecy to continuation applications that were in fact not secret. They have also failed to recognize that the numerical magnitude of secrecy effects in their findings were inconsequential compared to other factors that motivate continuation filings.

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on behavior, when one corrects for some identifiable lag in the prosecution of patents already in the system. For these overall data, continuation practice has fallen from a high of 28% in 1997 to 19% in 2000, nearly returning in the last years to the level of continuation use that had been the norm in the 1970s and early 1980s.").

[251] Graham dissertation (2004), note 239, Figure 2.6.

[252] S. Baker and C. Mezzetti, Disclosure As A Strategy In The Patent Race, *Journal of Law and Economics*, **48**(1),pp. 173-194, (April 2005) (discusses evidence that disclosures in patents are often purposely made not solely as defensive means in support of ones claims but also for enriching the prior art field, increasing obviousness barriers of rival patentees. Models a process whereby such disclosure makes it more difficult to patent and extends the patent race with attendant advantages to the discloser).

[253] Long (2002), note 36, (focusing on patents as a means for signaling and credibly publicizing information).

5 CONCLUSION

This paper presents a study of the historic shifts in patenting trends at the USPTO and reviews some of the prevailing theories on the subject. It shows that continuation applications have had an ever-increasing share of patenting activities. Two distinguishable patent application components can be observed. The first is new invention disclosures filed in original patent applications, arriving at a rate that follows the growth of science and technology and doubling about every 14 years. The second component is the demand for legal patent claim protection as manifested by the filing of continuation applications. It is shown that the exponential growth of the number of continuation applications doubles every 6.5 years, following the growth rate of new products introductions. It is shown that patent applicants' increased relative propensity to apply for continuation claims is related to the general historical trend of the shortening product lifecycle. The resultant patentees' efforts to appropriate equivalent returns from their inventions and secure patent protection for a rapidly changing new product offering is shown to be a major cause for the relative growth in continuation patenting. This study shows that the accompanying phenomenon to accelerated product obsolescence is that patent claims have gradually diminishing lifetime. It is suggested that, to a large degree, continuations facilitate an observed outcome in which U.S. patents are more likely to contain claims that are better matched to actual products and innovations in the market. In this regard, related evidence suggests that U.S. patents are more immune to patent lifetime erosion than foreign patents, for which no continuations are allowed.

That said, this study is the first to suggest and provide evidence that there is an overall shift in patents' scope characteristics over the last thirty years. It is shown that, on average, patents are issued with claims of gradually diminishing breadth relative to alleged infringing activities in the market and the accumulating prior art record. It is suggested that patent continuations contribute to such trend, which is in fact economically more optimal for private and public welfare. This paper shows that, contrary to assertions of the U.S. patent system critics, evidence is mounting to indicate that the numerical growth in patenting is deceiving and that, on average, private patent rights are not overbroad and are in fact less likely to suppress downstream innovation.

From this analysis emerges a model of patenting trends that has profound implications for the patent system of the 21st century. It predicts that due to shortening product lifecycles, innovators will pursue claims for their inventions in non-original patent applications at rates that will gradually approach or surpass their invention disclosure rates in original applications. This implies that under the current USPTO practice of examining claims in every patent application, the examination burden on the USPTO in a few years would expand and approach a doubling rate of 6.5 years. Thus, in the coming years, a much clearer delineation between the two pillars of the patent system will emerge and demand for claim protection events will be more clearly distinct from the underlying disclosure events.

On the other hand, this model also predicts that a greater fraction of submitted claims will be obsolete to their owners by the time they can be issued in a patent. This implies that the USPTO will be faced with increasing burdens of examining claims that, after the fact, prove unworthy of having been examined. It is precisely in situations such as this, that a system of patent ***examination-by-request*** can be most efficient. It is hard to envision how the USPTO would be able to address the growing examination burden associated with the shortening product lifecycle without also taking advantage of the related claim obsolescence phenomenon. These two attributes are inextricably linked and any efficient patent examination regime must also rely on claim obsolescence. It is therefore suggested that a transition to examination-by-request at the USPTO can provide the much-needed relief in the workload and backlog at the USPTO. Under this examination regime, there will be a set time period (say 3-5 years) after a patent application is filed for requesting claim examination at the USPTO. It is proposed here that examination may be triggered by any party after publication of the applications, and not just by the request of the applicant. Applications for which no request is filed within the set period will be deemed abandoned and will never be examined. Based on the 4-year renewal statistics of the USPTO, at least 10%-20% of claims will never reach examination under this proposed regime and the USPTO would likely see an ***immediate*** decline by at least such amount in its examination burden. It is important to recognize the self-regulating aspect of the examination-by-request regime for USPTO workload going forward. This is because changes in demand for claim examination associated with product lifecycle changes are also accompanied with concomitant changes in claim obsolescence, mitigating the claim examination burdens. Therefore, the examination-by-request system is ultimately the fairest solution to the USPTO workload problem because it cuts down substantially on the number of claims that must be examined, without denying patentees' right to obtain claims for any invention.

Appendix A Numerical Data

Source	1	calc.	1	1	1	1	calc.	1	1	2	3
Item	A	B	C	D	E	F	G	H	J	K	L
Fiscal Year	Total Applications (excluding design patent applications)	Original Applications = A- G- H- J	Continuation Applications	Continued Prosecution Applications (CPAs)	Requests for Continued Examination (RCEs)	Rule 129 Continuations	Total Continuations of all kinds = C+D+E+F	Continuation In Part (CIP) Applications	Divisional Applications	New Product Announcements on PR NewsWire	New Trademark Applications
1980	93,800	78,644	6,022				6,022	4,585	4,549		52,149
1981	107,513	89,848	6,764				6,764	5,743	5,158		55,152
1982	116,731	95,924	9,097				9,097	5,871	5,839		73,621
1983	97,448	82,206	6,764				6,764	5,023	3,455		51,014
1984	109,539	89,401	9,509				9,509	5,903	4,726		61,480
1985	116,427	92,723	11,882				11,882	6,648	5,174		64,677
1986	121,611	94,891	14,036				14,036	7,383	5,301		69,253
1987	126,407	97,549	15,466				15,466	7,745	5,647		70,002
1988	137,069	105,168	16,923				16,923	8,432	6,546		76,813
1989	151,331	114,709	19,184				19,184	9,282	8,156		83,169
1990	163,561	124,524	19,962				19,962	10,222	8,853		127,294
1991	167,715	125,007	22,346				22,346	10,980	9,382		120,365
1992	172,539	125,165	26,086				26,086	11,968	9,320		125,237
1993	174,553	124,263	28,067				28,067	12,690	9,533		139,735
1994	186,123	130,050	31,750				31,750	13,753	10,570		155,376
1995	221,304	139,976	37,563			1,612	39,175	15,881	26,272		175,307
1996	191,016	141,932	23,735			5,016	28,751	10,500	9,833		200,640
1997	220,773	164,912	28,673			3,737	32,410	10,914	12,537	23,133	224,355
1998	240,090	182,736	14,016	17,461		2,356	33,833	11,288	12,233	24,659	232,384
1999	261,013	195,460	13,239	25,258		949	39,446	12,257	13,850	29,186	295,165
2000	293,244	213,694	17,613	30,888	1,033	444	49,978	13,764	15,808	40,557	375,428
2001	326,081	237,184	21,436	22,406	12,438	206	56,486	14,472	17,939	36,130	296,388
2002	333,688	240,651	25,601	8,978	25,677	118	60,374	14,421	18,242	32,805	258,873
2003	333,452	231,045	26,135	2,333	39,562	87	68,117	14,566	19,724	38,710	267,218
2004	355,527	247,178	27,989		45,945	40	73,974	14,962	19,413	42,424	298,489
2005	384,228	264,569	30,754		54,332	8	85,094	15,434	19,131	46,231	323,501

Sources:

1. USPTO, FOIA request patent data, note 39 and corrections from USPTO slides, note 40.
2. PR NewsWire, note 115.
3. USPTO Trademark registration applications, note 117.